The Lepidoptera of Marine Corps Air Station Miramar: Calculating Faunal Similarity among Sampling Sites and Estimating Total Species Richness

John W. Brown
Systematic Entomology Laboratory, U.S. Department of Agriculture, PSI, ARS, c/o National Museum of Natural History, Washington, DC 20560-0168 U.S.A., E-mail: *jbrown@sel.barc.usda.gov*

Katherine Bash
Department of Zoology, University of Texas, Austin, Texas 78712 U.S.A

Abstract. An intensive 3-year survey of the Lepidoptera of Marine Corps Air Station Miramar in southwestern San Diego County, California, was conducted from October 1995 through September 1998. Sampling methodology included blacklight trapping (364 nights), diurnal collecting (148 days), and pheromone "baiting." About 646 species of Lepidoptera were documented from the Station, including 20 (or more) undescribed moth species and one "sensitive" butterfly species - Hermes copper, *Lycaena hermes* (Edwards). Two species were newly recorded for the United States - *Dryadaula terpsichorella* (Busck) (Tineidae) and *Metapluera potosi* Busck (Gelechiidae). While the species accumulation curve reached a convincing asymptote, it is highly unlikely that all species of Lepidoptera present on the Station were sampled. Four methods extrapolated or estimated the fauna to be between 706 and 922 species. Based on the family Geometridae, faunal similarity among a subset of 10 permanent blacklight sites ranged from 0.29 to 0.69. We briefly discuss how Lepidoptera inventories may provide insight into identification of areas of high conservation value.

Key Words: Insecta, Lepidoptera, faunal survey, inventory, coastal sage scrub, conservation, species richness.

Introduction

Over the last decade the maintenance of biological diversity has become an issue of both local and global concern. The values of maintaining biodiversity have been discussed by numerous authors and were summarized best by Ehrlich (1990) as ethical, aesthetic, economic, and the provision of "ecosystem services." Before we can attempt to maintain biodiversity we must know its components; i.e., it is impossible to establish goals and/or methods for the long-term management and protection of biological resources without knowing what resources are present. Therefore, the process of inventory represents the first critical step in all efforts to effectively maintain biodiversity.

Because it is virtually impossible to inventory, monitor, and manage all aspects of a local or regional biota, specific taxa may be selected as "indicator" or "umbrella" species (or groups) based on their ability to reflect the diversity or health of an ecosystem and their ability (or inability) to respond to

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changing environmental conditions. New (1998) and others (e.g., Eyre & Rushton 1989, Sutton & Collins 1991, Kremen et al. 1993, Oliver & Beattie 1994) present convincing arguments that the use of insects for documenting biodiversity, assessing ecosystem health, monitoring environmental change, and identifying areas of high conservation value has many advantages over the use of vertebrates or vascular plants (but for differing points of view see Howarth & Ramsey 1991, Scott et al. 1993, Noss & Cooperrider 1994). Owing to insect abundance and diversity, the complex interrelationships between them and other organisms form the most prevalent and comprehensive elements of the fabric of all terrestrial and freshwater aquatic biological communities (Powell 1995). Insects frequently exhibit rapid and perceivable responses to habitat modification (e.g., local or regional changes in abundance, extinction and colonization of habitat patches, range expansions and contractions) (e.g., Kempton & Taylor 1974, Taylor et al. 1978, Pollard 1979, Razowski 1985, Murphy & Weiss 1991); non-biased, standardized techniques are available for sampling many types of insects (e.g., Merritt & Cummings 1978); large numbers of individuals can be sampled reliably over short periods of time (e.g., Murphy & Weiss 1988a, b); collections of insects can be stored easily and efficiently and maintained for verification of data and future use; and there are fewer societal and ecological constraints to collecting insects (e.g., Murphy & Weiss 1988b). The use of Lepidoptera as an exemplar taxon for estimating overall insect diversity has advantages that include the relative ease of identification at the species level (for many families), standardized sampling methodology (e.g., Thomas & Thomas 1994), and a high correlation with the spatial, architectural, and taxonomic diversity of vascular plants (e.g., Southwood et al. 1979, Brown & Opler 1990, Panzer & Schwartz 1998). In addition, Lepidoptera comprise the richest group of phytophagous insects in California.

A survey of the Lepidoptera of Marine Corps Air Station (MCAS) Miramar (= the Station), situated in southwestern San Diego County, California, was conducted from October 1995 through September 1998 by personnel associated with the San Diego Natural History Museum, under contract with the U.S. Navy. While the primary goal of the survey was to determine the presence/absence of one butterfly species (i.e., *Euphydryas editha quino* (Wright)) listed as endangered and two others (*Lycaena hermes* (Edwards) and *Euphyes vestris harbisoni* Brown & McGuire) formerly recognized as candidates for listing by the U.S. Fish and Wildlife Service, the fieldwork resulted in considerable information on local Lepidoptera diversity and phenology. This information may represent a baseline against which the effect of future environmental changes may be assessed.

Our purposes are to present an inventory of the Lepidoptera documented from MCAS Miramar; provide a cumulative or summary seasonal phenology for each species and the Lepidoptera community in general; estimate total species richness of the Station based on a number of different assumptions; discuss faunal similarity and site complementarity among a subset of 10

blacklight sampling sites; and identify features that may be useful in assessing the potential conservation value of any area based on its Lepidoptera fauna.

Materials and Methods

Study Site

The study site, MCAS Miramar (formerly Naval Air Station Miramar), is an approximately 10,500-hectare (23,000-acre) property owned and managed by the U.S. Marine Corps, situated in the southwestern portion of San Diego County, California (Fig. 1), at about 33°N, 117°W. The Station extends nearly 16 km (10 miles) east-to-west, roughly from Santee Lakes to Interstate Highway 805, and about 5 km (3 miles) north-to-south, from Miramar Road to State Route 52. Elevations on the Station range from about 30 to 250 m above mean sea level.

While portions of the Station are highly disturbed/developed, with aircraft runways, warehouses, family housing, and an extensive road system, the vast majority supports native biotic communities, including coastal sage scrub, scrub oak chaparral, southern mixed chaparral, chamise chaparral, southern willow scrub, sycamore alluvial woodland, oak riparian woodland, and valley needlegrass grassland. The Station also supports extensive acreage of vernal pool habitat, a rare and highly depleted, ephemeral wetland community. This situation is not unusual in California or elsewhere in the United States, where military reservations often represent bastions of biodiversity in otherwise highly urbanized landscapes. Sampling was restricted to portions of the Station where native habitat occurs; we sampled about 50% of the entire site.

Several of the plant communities on the Station are highly depleted assemblages restricted to southern California. Among these are coastal sage scrub, the object of significant conservation efforts and the focus of the State of California's Natural Communities Conservation Plan. This community supports a large number of plant and animal species listed as rare, threatened, or endangered by the resource agencies, the most notable of which is the coastal California gnatcatcher (*Polioptila californica californica*), a small gray songbird. Coastal sage scrub occurs in a mosaic distribution with other native scrub and wetland communities, each of which contributes to the overall stability and long-term viability of the natural landscape.

Collecting Methods

Three general techniques were utilized to collect Lepidoptera: 1) blacklight trapping; 2) diurnal collecting; and 3) pheromone "baiting." Each of the methods is described below.

Blacklight Trapping. Through a trial-and-error approach, 10 permanent blacklight trapping sites were established during the first three months of the program; three additional sites were added during the second year (Fig. 1). The sites were located in all major habitat types on the Station as characterized by the base Geographic Information System vegetation mapping, including coastal sage scrub, chaparral, grassland, oak woodland, willow woodland, and sycamore/oak woodland. The thirteen sites are characterized in Table 1.

Regardless of season, ambient temperature, or phase of the moon, once a month each of the sites was sampled using two, three, or four blacklight traps, each equiped with a 15-watt ultra-violet light. The traps were deployed in the evening and retrieved the following morning. Blacklight trapping was conducted on 364 nights over the 3-year period. The frequency of trapping nights per month from October 1995 through September 1998 is illustrated in Fig. 2.

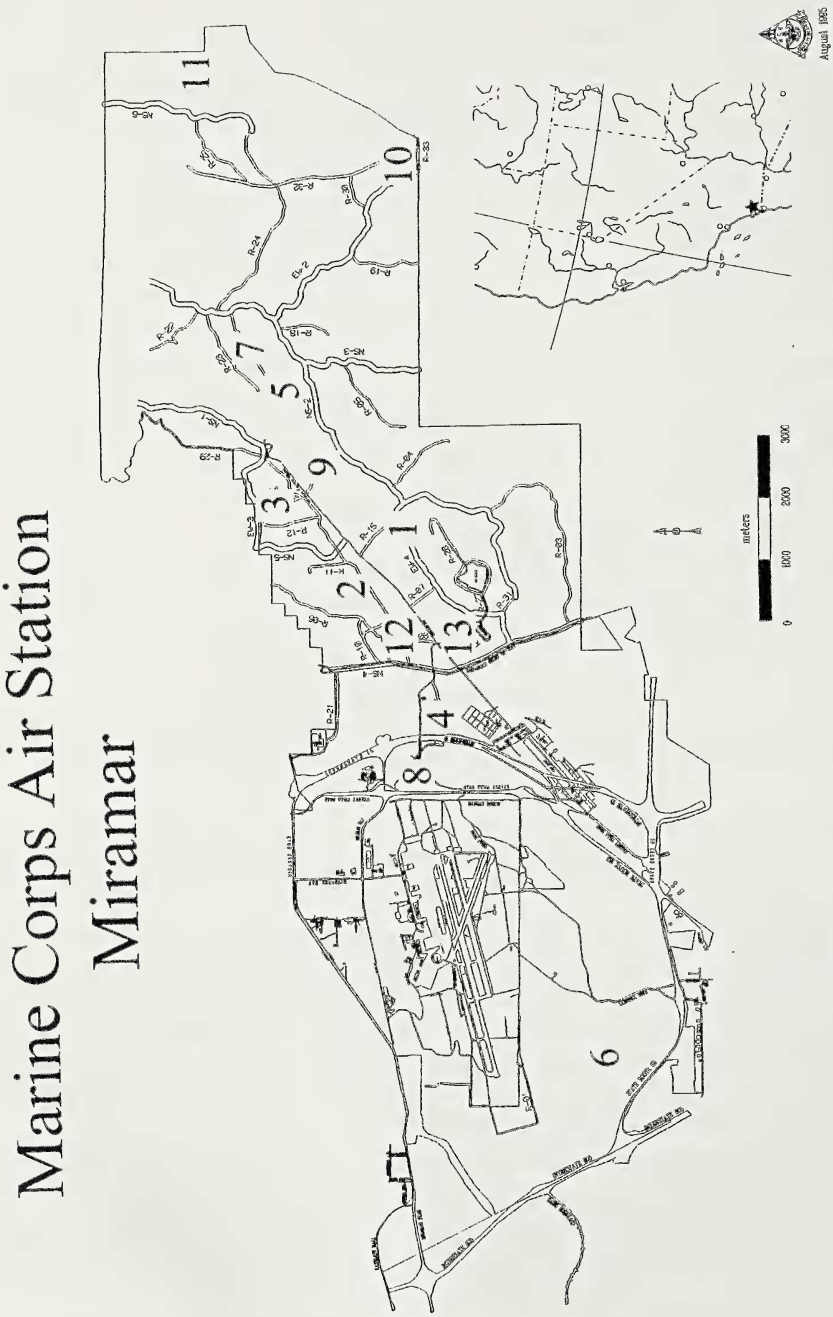

Fig. 1. Map of Marine Corps Air Station Miramar, with locations of sampling sites.

Table 1. Blacklight sampling sites.

Site	Habitat type	Location
1	Chaparral Ridge	1.5-2.2 km east of Interstate 15 (I-15), ca. 0.4 km south of Green Farm Road.
2	Coastal sage scrub/sparse sycamore woodland	ca. 1.5 km east of I-15, ca. 0.2 km north of Green Farm Road.
3	Southern willow scrub surrounded by chaparral	ca. 4.5 km east of I-15, ca. 0.8 km north of Green Farm Road.
4	Coyotebrush scrub/scrub oak chaparral	immediately east of I-15, west end of Green Farm Road.
5	Area surrounding pond, including freshwater marsh, open water, and coastal sage scrub	just east of Green Farm.
6	Sycamore/oak riparian woodland	San Clemente Canyon near Miramar Landfill, west of Convoy Street.
7	Chaparral	ridge ca. 5.1 km east of I-15, ca. 0.4 km south of Green Farm Road.
8	Vernal pool and grassland	southwest of intersection of I-15 and Miramar Road.
9	North-facing chaparral slope	ca. 0.8 km east of Green Farm, ca. 0.2 km south of Green Farm Road.
10	Sycamore woodland/coastal sage scrub	West Sycamore Canyon, just northwest of Santee Lakes.
11	Oak riparian forest	Sycamore Canyon, ca. 2.2 km northwest of Santee Lakes.
12	Hilltop with coastal sage scrub and chaparral	just east of the pipeline scar, ca. 0.8 km north of Green Farm Road.
13	Coastal sage scrub and chaparral	adjacent to the pipeline scar, ca. 1.5 km south of Green Farm Road.

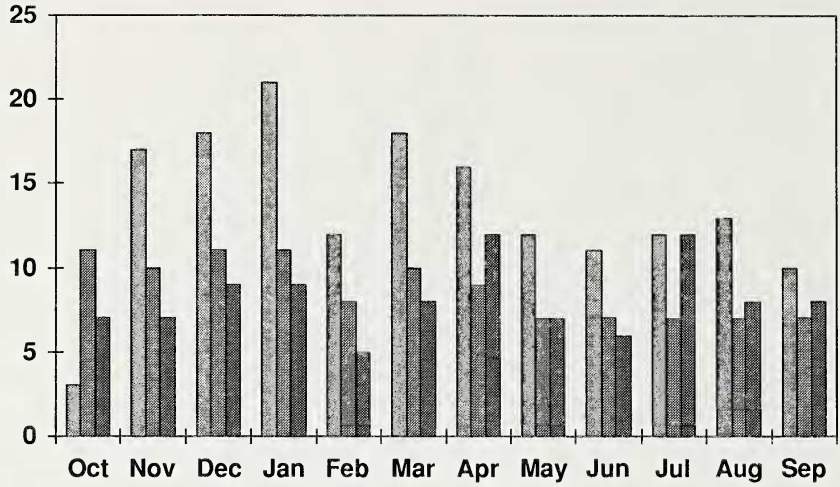

Fig. 2. Frequency of blacklight sampling by month; *x*-axis = month of the year, *y*-axis = number of sampling dates; first bar of each month = 1995-1996; second bar = 1996-1997; third bar = 1997-1998.

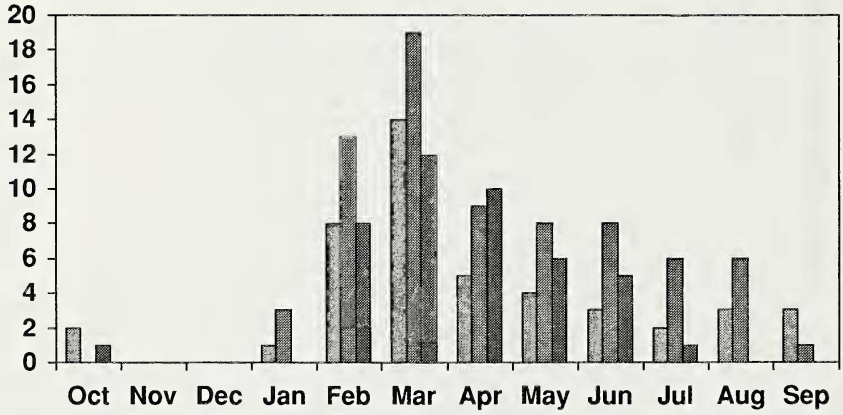

Fig. 3. Frequency of diurnal sampling by month; *x*-axis = month of the year, *y*-axis = number of sampling dates; first bar of each month = 1995-1996; second bar = 1996-1997; third bar = 1997-1998.

Diurnal collecting. Diurnal collecting was concentrated from the middle of February through the end of June to coincide with peak adult activity of the three target species of butterflies (i.e., *Euphydryas editha quino, Lycaena hermes, Euphyes vestris harbisoni*). Additional diurnal collecting was conducted sporadically throughout the remainder of the year. During the visits, meandering transects were walked while searching for adult Lepidoptera, primarily butterflies. Diurnal collecting was conducted on 148 days. The frequency of diurnal collecting per month from October 1995 through September 1998 is illustrated in Fig 3.

Because many species of butterflies are attracted to surface moisture, artificial

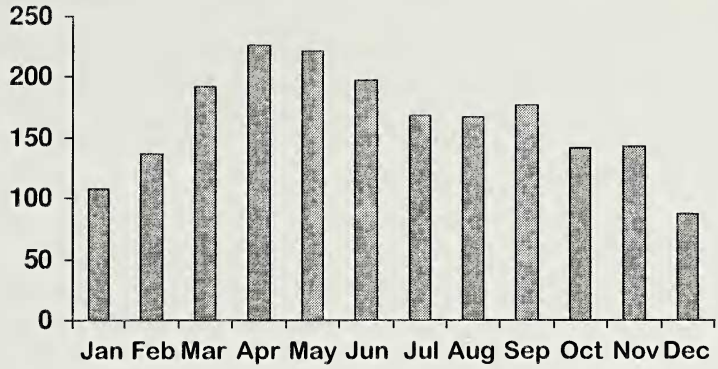

Fig. 4. Generalized annual pattern of adult Lepidoptera activity on the Station; *x*-axis = months of the year, *y*-axis = number of species collected/observed.

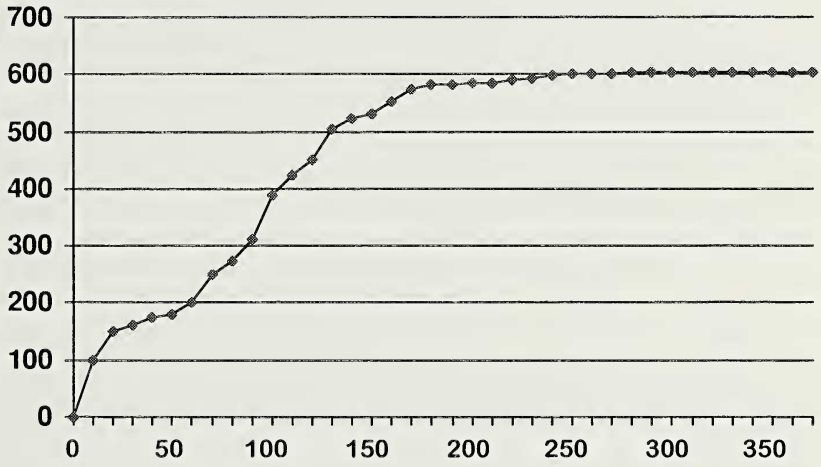

Fig. 5. Species accumulation curve; *x*-axis = cumulative number of sampling nights, *y*-axis = cumulative number of species collected/observed.

"puddles" were created during several diurnal surveys in May, June, and July 1996, by spraying water onto the surface of dirt roads. Also, because males of many butterfly species exhibit hilltopping behavior, brief visits frequently were made to the most prominent hill in the vicinity of the survey locality.

During the first full year of diurnal surveys (i.e., 1996), minimal time was spent examining vegetation for the presence of larval Lepidoptera; no time was invested in subsequent years. When larvae were discovered, they were taken to the laboratory and kept in half-gallon cardboard containers along with cuttings of the larval food plant.

Pheromone baiting. Aluminum pie plates filled with ethylene glycol (anti-freeze) (= pan traps) and baited with a synthetic sesiid moth pheromone were deployed at

several of the permanent blacklight sites from about the middle of April through the middle of August 1996.

In October 1996 we used synthetic pheromone of *Hemileuca electra* (Wright) (Saturniidae) to determine the presence/absence of this species on the Station. In February 1997, we used a virgin female *Saturnia walterorum* Hogue & Johnson (Saturniidae) in an effort to attract males of this species to determine the presence of a resident population on the Station.

Data Analyses

The first date of capture was recorded for each of the identified species; for most unidentified species this date was not recorded because there was uncertainty regarding the taxonomic integrity of most of the "morphospecies." A species accumulation curve (Fig. 5) was derived by plotting the cumulative number of species documented from the Station against cumulative number of sampling nights; only identified species were included ($n \approx 600$).

For each identified species, all months of capture were recorded. The total number of species documented for each month (January through December) was tallied and used to generate a histogram illustrating the seasonal phenology or temporal distribution of the entire Lepidoptera community. Although flight periods of some species vary from year to year depending on environmental cues (e.g., timing of rainfall, winter/spring temperatures), such annual fluctuations probably contribute little to the overall pattern of community phenology.

Using the family Geometridae as an exemplar taxon, we constructed a matrix of species by blacklight sampling site (using sites 1-10 as a subsample). We used this matrix to evaluate faunal similarity and site complementarity. Faunal similarity (FS) was calculated by the following equation: $FS = C/(A+B)-C$, where "A" is the number of species recorded from site A, "B" is the number species recorded from site B, and "C" is the number of species shared by sites A and B. Complementarity (D) (dissimilarity), which is defined as the inverse of faunal similarity, was derived using the following equation: $D = 1-FS$, where FS equals faunal similarity.

Nomenclature, Arrangement of Taxa, and Disposition of Material

Scientific nomenclature and the sequence of families, genera, and species follow Hodges et al. (1983). Specimens from fieldwork conducted in 1995-1996 are deposited in the Entomology Department of the San Diego Natural History Museum; specimens from 1997 are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.; specimens from 1998 are deposited in the Essig Museum of Entomology, University of California, Berkeley. The last material was used in development of the species accumulation curve and the overall species inventory, but not was included in the compilations of species' phenology or calculations of site complementarity because it was not examined by us.

Results and Discussion

Fieldwork resulted in the collection of about 30,000 specimens representing about 646 species (Appendix A). Because numerous specimens of microlepidoptera are not yet identified (and are unlikely to be identified in the foreseeable future), it is likely that the actual total may exceed 700 species.

Nocturnal Lepidoptera

As would be expected, the Noctuidae (161 species; 25%) and Geometridae (90 species; 14%) comprise the largest portions of the Lepidoptera fauna. Other families that are well represented in the fauna of the Station include Pyralidae (including Crambidae) (75 species; 12%) and Tortricidae (60 species; 9%).

Among the material collected in blacklight traps were 20 (or more) undescribed species, including at least one species of *Amydria* (Acrolophidae) (D. Davis, pers. comm.), a species of *Lampronia* (Incurvariidae) (D. Davis, pers. comm.), two species of *Gnorimoschema* (Gelechiidae) (J. Powell, pers. comm., Povolny 1998), at least nine species of Blastobasidae (D. Adamski, pers. comm.), three species of Tortricidae, and four species of Noctuidae (T. Mustelin, pers. comm.). Also collected in blacklight traps were about 40 specimens of *Metapleura potosi* Busck (Gelechiidae), a Mexican species previously unrecorded from the United States, and a single specimen of *Dryadaula terpsichorella* (Busck) (Tineidae), also new to the U.S. fauna.

Among the Tortricidae are a new species of *Decodes* (Powell & Brown 1998), a new *Epinotia* (R. Brown, pers. comm.), and a new *Eucosma* (related to *E. hazelana* Klots). Among the Noctuidae are a new *Aseptis*, a new *Xylomoia*, a new *Lacinipolia*, and a new genus (and species) near *Miodera*. It is highly unlikely that any of the new species is restricted to the Station. For example, the new *Decodes* is known from two of the California Channel Islands, Silverwood Audubon Sanctuary (in central San Diego County), and northwestern Baja California, Mexico (Powell & Brown 1998). The new genus of Noctuidae is known from San Diego, Riverside, and San Bernardino counties, from sea level to about 1400 m (Mustelin, unpubl.).

Diurnal Lepidoptera

Species collected only during diurnal sampling represent about 11% of the Lepidoptera fauna of the Station. Four species of yucca moths (2 *Tegeticula* and 2 *Prodoxus*; Prodoxidae) were collected from the flowers of *Yucca whipplei* (Liliaceae). Five species of clearwing moths (Sesiidae) were collected in pan traps baited with pheromone. A single specimen of *Hemaris diffinis* (Boisduval) (Sphingidae) was collected and a second individual observed. The latter species previously was known in San Diego County only from the interior montane region.

Other diurnal Lepidoptera included one species of fairy moth (*Adela* sp.), one species of Plutellidae (*Pliniaca bakerella* Busck), and a small number of noctuids (e.g., *Schinia* spp.), geometrids (e.g., *Stamnodes* spp.) and pyralids, about half of which were not duplicated in blacklight samples.

Cnephasia longana (Haworth) (Tortricidae) was one of about 10-12 species collected both diurnally and in blacklight traps; it was abundant on the Station. Powell (1997) chronicled the spread of this Palaearctic moth southward and northward from the San Francisco Bay area, reporting it as far south as Santa Rosa Island. The presence of this species on MCAS Miramar

represents a southern range extension of approximately 300 km from its previously documented range.

Using a synthetic pheromone for the diurnal buckmoth (*Hemileuca electra*), we attracted males of this rapid-flying species. It was abundant on the section of the Station known as Parcel G (Rubinoff 1998), but it is likely to be common wherever flat-top buckwheat (*Eriogonum fasciculatum* Benth.; Polygonaceae) is common. Using a virgin female *Saturnia walterorum*, we successfully attracted males of this species on the Station.

Fifty-one species of butterflies were recorded, approximately 40% of the butterfly fauna of San Diego County (i.e., about 125 resident species). Furthermore, it is likely that a few additional butterflies species are present and were not detected. For example, several common urban skippers (Hesperiidae) present in adjacent developed areas were not detected on the Station.

During 1996, single individuals of Hermes copper (*Lycaena hermes*) were observed at one location on the Station on two occasions. In 1997 this species was found at five different sites; it was common in both 1997 and 1998. Neither quino checkerspot (*Euphydyras editha quino*) nor Harbison's dun skipper (*Euphyes vestris harbisoni*) was observed.

Larval Lepidoptera

Larvae of only four species of Lepidoptera were collected in 1996: *Orgyia vetusta* on *Lotus scoparius* (Fabaceae); *Hemileuca electra* on *Eriogonum fasciculatum* (Polygonaceae); *Apantesis nevadensis* on *Lotus*, *Eriogonum*, and *Erodium* (Geraniaceae); and *Vanessa virginiensis* on *Gnaphalium californicum* (Asteraceae). All but the *Vanessa* were successfully reared to maturity.

Temporal Distribution

Appendix A presents a cumulative summary of the temporal distribution (for 1995-1997) of the identified Lepidoptera based on all survey methods; for most of the unidentified species, data are not presented. Based on the larger moths, butterflies, and identified small moths, the potential number of species per month ranged from a high of 226 in April to a low of 87 in December. A histogram of the overall annual pattern of adult Lepidoptera activity on the Station is presented in Fig. 4. In general, activity increases from January, peaking in April and May, stays relatively high through September, drops in October, and declines dramatically in December.

When we examine one family, such as the Geometridae, we find considerable deviation from the overall pattern described above. For example, geometrid adult activity was lowest in September (n = 14 species), increased through late winter and early spring (December through February), and peaked in March (n = 48 species). The Geometridae represented approximately 37% of the species sampled in January. This deviation from the overall pattern is not surprising: many geometrids fly in the winter and thus have been given the common name "winter moths."

Even during the period of lowest moth activity (i.e., December), at least 87

species (about 13.5% of the Lepidoptera fauna) were collected. Although the vast majority of species exhibited distinct seasonal patterns, a few species were present almost year-round: *Pseudochelaria scabrella* (Busck), *Holcocera gigantella* (Chambers), *Eucsoma pulverulenta* (Walsingham), *Amorbia cuneana* (Walsingham), *Pero radiosaria* (Hulst), *Aethaloidia packardaria* (Hulst), *Pherne subpunctata* (Hulst), *Apantesis proxima* (Guerin-Menetries), *Agrotis ypsilon* (Hufnagle), and *Spodoptera exigua* (Hübner). This pattern is most evident in Tortricidae, Geometridae, and Noctuidae - families that include many polyphagous, pest species that are opportunistic in their larval food plant selection.

Faunal Similarity and Site Complementarity

Using the family Geometridae (n = 90 species) as an exemplar taxon, we calculated faunal similarity and its inverse, complementarity (dissimilarity), among a subset of 10 permanent blacklight sampling sites. The number of species documented per site varied from 21 (23% of the geometrid fauna; site 8) to 56 (62%; site 3); one species was collected only diurnally on a meandering transect. This substantial variability suggests that although the native habitat on the Station has a rather homogeneous appearance, plant communities and the features that determine them (e.g., slope, exposure, soil type) strongly influence the fauna, resulting in localized assemblages of species. This finding corroborates the *a priori* (and highly logical) assumption that in order to maximize the number of species sampled, it is imperative to maximize the number of plant communities and microhabitats sampled. It also suggests that blacklights may attract only geometrid species that are in the immediate vicinity, suggesting localized or patchy distribution of many species. These data may be biased by the fact that blacklight traps are not as effective for geometrids as they are for noctuids (J. Powell, pers. comm.).

Faunal similarity (FS), as defined in the Materials and Methods section, is equivalent to Jacard's coefficient of similarity. This measure, emphasizing shared presence and disregarding shared absence, is useful in many biogeographic and conservation contexts. Tables 2 and 3 present the "unreduced" and "reduced" faunal similarity values, respectively, for a subset of 10 blacklight trapping sites (i.e., sites 1-10). As illustrated in Table 2, the highest combined species richness for any two sites was 73 (81% of all geometrids) (sites 6 and 7) and the lowest was 42 (47% of the geometrids) (sites 4 and 8). The highest number of shared species was 41 (by sites 2 and 7, and sites 3 and 7), the lowest was 13 (by sites 4 and 8). The low values for both combined species richness and shared species can be explained by the fact that sites 4 and 8 yielded the lowest numbers of species (i.e., 34 and 21, respectively) of the 10 sites. Faunal similarity (Table 3) was highest (0.69) between sites 2 and 7 and lowest (0.29) between sites 1 and 8 and 6 and 8. Mean faunal similarity was lowest for site 8 (0.32), a grassland area, and highest for site 2 (0.55), a site supporting coastal sage scrub and sparse sycamore woodland.

Complementarity (dissimilarity) (Table 4) varied from 0.31 (between sites 2 and 7) to 0.71 (between sites 1 and 8, and sites 6 and 8). While

Table 2. "Unreduced" values of faunal similarity (based on Jacard's coefficient of similarity) for a subset of 10 blacklight sampling sites. Highest and lowest values in **bold face**.

	1	2	3	4	5	6	7	8	9	10
Site 1	-									
Site 2	36/60	-								
Site 3	37/65	39/67	-							
Site 4	24/56	30/54	28/62	-						
Site 5	30/59	33/60	34/65	25/55	-					
Site 6	33/68	37/68	39/71	28/61	35/63	-				
Site 7	36/60	**41**/59	**41**/65	26/58	32/61	32/**73**	-			
Site 8	15/52	18/53	18/59	**13/42**	16/48	17/59	21/54	-		
Site 9	37/59	38/62	40/66	25/59	33/60	36/69	38/62	17/54	-	
Site 10	23/66	29/64	31/68	23/54	26/60	32/66	26/63	16/48	29/65	-

Table 3. Faunal similarity (based on Jacard's coefficient of similarity) for a subset of 10 blacklight sampling sites. Highest and lowest values in **bold face**.

	1	2	3	4	5	6	7	8	9	10
Site 1	-									
Site 2	0.60	-								
Site 3	0.57	0.58	-							
Site 4	0.43	0.56	0.45	-						
Site 5	0.51	0.55	0.52	0.45	-					
Site 6	0.49	0.54	0.55	0.46	0.56	-				
Site 7	0.60	**0.69**	0.63	0.45	0.52	0.44	-			
Site 8	**0.29**	0.34	0.31	0.31	0.33	**0.29**	0.39	-		
Site 9	0.63	0.61	0.61	0.42	0.55	0.52	0.61	0.31	-	
Site 10	0.35	0.45	0.46	0.43	0.43	0.48	0.41	0.33	0.45	-

Table 4. Complementarity (dissimilarity) for a subset of 10 blacklight sampling sites. Highest and lowest values in **bold face**.

	1	2	3	4	5	6	7	8	9	10
Site 1	-									
Site 2	0.40	-								
Site 3	0.43	0.42	-							
Site 4	0.57	0.44	0.55	-						
Site 5	0.49	0.45	0.48	0.55	-					
Site 6	0.51	0.46	0.45	0.54	0.44	-				
Site 7	0.40	**0.31**	0.37	0.55	0.48	0.56	-			
Site 8	**0.71**	0.66	0.69	0.69	0.67	**0.71**	0.61	-		
Site 9	0.36	0.39	0.39	0.58	0.45	0.48	0.39	0.69	-	
Site 10	0.65	0.55	0.54	0.57	0.57	0.52	0.59	0.67	0.55	-

complementarity is a relative indicator of dissimilarity, its value does not precisely reflect the presence of "different" species at the sites being compared. For example, site 8 had the highest complementarity values, but supported few species not present on other sites. Its overall high complementarity is the result of its low species number (i.e., the absence of shared species with other sites or "mismatches" based on absence) rather than its uniqueness (i.e., the presence of different species or species not present on other sites).

Species Richness Estimates

The species accumulation curve (Fig. 5) shows that the rate of encountering new species increased throughout the first year and began to reach an asymptote by October 1996. During the first year each successive month added an average of about 40 species to the inventory. In contrast, during the entire second year only 27 species total were added. This suggests that the first year of the survey successfully captured about 95% of the fauna. Only six additional species were added in the third year. Because sampling was conducted with greater frequency during the first year, these findings may be slightly biased; i.e., it is likely that uniform sampling during each of the three years would have produced slightly different results.

While we have documented about 646 species of Lepidoptera from Station (not all of which are identified and many of which are undescribed), and the species accumulation curve has reached a convincing asymptote, this number (646) may underestimate the fauna. The number of species potentially present can be estimated or extrapolated by at least four different methods: (1) comparison with plant species richness; (2) extrapolation from butterfly species richness; (3) evaluation of taxonomic components of the documented fauna; and (4) "Chao 1," a non-parametric statistical model.

Powell (1995) has found Lepidoptera species richness to be 1.5 – 3.0 times plant species richness at other sites in California (e.g., Big Creek in Monterey County). Because the flora of MCAS Miramar includes about 615 species of vascular plants (Wier & Brown, unpubl.), a conservative estimate of the Lepidoptera based on Powell's findings would be 922 species. Based on inventories of other sites in California, this estimate is too high; it may reflect the fact that the Station has been subject to numerous intensive botanical surveys that may be cumulatively more thorough than those of the sites used for Powell's calculations. Alternatively, Powell's values of 1.5-3.0 may not be applicable over a broad ecological range. The latter seems unlikely given that Powell has investigated habitats as diverse as redwood forest and coastal sand dunes. It is more likely that such extrapolations are not meaningful owing to the considerable difference in size of the study areas; i.e., the Station is nearly seven times the size of Powell's most thoroughly surveyed site, Big Creek.

Throughout the western United States, butterfly species typically represent about 7% of the Lepidoptera species richness at any particular site or geographic region (Powell 1995). Because butterflies are diurnal, easily observed, and comparatively easily identified, resident butterfly species

richness can be documented fairly accurately in the western United States. If we extrapolate from the total number of butterfly species we observed (n = 51), we would expect the total Lepidoptera fauna to be about 729 species. This value seems a little high, but certainly is within a reasonable expected range based on other California inventories.

When we examine the relative components of the general "taxonomic" categories of Lepidoptera (i.e., Microlepidoptera, Pyraloidea, butterflies, Macrolepidoptera), we find that we are conspicuously low in the Microlepidoptera category. That is, Macrolepidoptera and Microlepidoptera typically each represent about 40% of the Lepidoptera fauna at most sites in California (Powell 1995). While we recorded about 287 species of Macrolepidoptera, we recorded only about 222 *identified* species of Microlepidoptera. Many species of Microlepidoptera are confined to highly localized areas that support their larval food plant, are not efficiently captured in blacklight traps, are exceedingly small and difficult to prepare, and are difficult to identify. If the Microlepidoptera richness of the Station is comparable to the sampled Macrolepidoptera richness (i.e., 287 species), the total Lepidoptera fauna would be about 65 species greater than we documented, or about 711 species. This value is fairly consistent with our estimates of the number of undetermined Microlepidoptera in our samples and the probability that this group has been under-sampled using our methodology.

Chao 1 (Chao 1984) is a non-parametric statistical model that can be used to estimate species richness from samples (e.g., Colwell & Coddington 1994). It is represented by an easily calculated mathematical equation: $S_t = S_{ob} + a^2/2b$, where S_t is the estimated species richness, S_{ob} is the observed species richness ($n \approx 646$), "a" is the number of species represented by a single specimen ($n \approx 62$), and "b" is the number of species represented by two specimens ($n \approx 32$). The equation focuses on the number of species represented by one and two individuals because these are likely indicators of under-sampling. Using this equation we derive an estimate of about 706 species. This number is clearly a conservative estimate (or under-estimate) because with the exception S_{ob} it is based entirely on species that we have been able to identify at least to morphospecies.

If we disregard the conspicuous outlier (n = 922), based on the three other estimates described above, the total number of species on the Station may be between 706 and 729, with an average estimate of 715 species.

The most logical interpretation for the "false" asymptote of the species accumulation curve is that the pool of species that can be detected reliably using the methodologies we employed was nearly exhausted. This suggests that utilization of additional or different collecting techniques would add species to the inventory, in particular, the diverse leaf-mining fauna is poorly represented in our samples.

It is apparent that to sample thoroughly the entire Lepidoptera fauna of any site, one must employ a variety of techniques: diurnal sampling (i.e., approximately 11% of the fauna of MCAS Miramar was detected only by diurnal sampling), blacklighting (which yields the vast majority of moth

species), pheromone "baiting" (which may be the best way to sample adequately Sesiidae and some Saturniidae), and larval collecting (particularly for leaf-mining and other Microlepidoptera). While our survey did not demonstrate that multiple years significantly increase the number of species detected (i.e., an increase of only about 5% was observed during the second year), it is likely that multiple years of effort are necessary to document some species. Our results are biased by the fact that nearly 45% of our entire sampling was conducted during the first year. According to Powell (1995), multiple-year surveys are less affected by fluctuations in year-to-year abundance and also have a higher likelihood of documenting vagrant and migrant species that may not be resident. The latter is not exclusive to multiple-year surveys; for example, it is highly likely that *Magusa orbifera* (Walker) and *Ascalapha odorata* (L.), each recorded once from the Station, are non-residents.

One of the greatest difficulties encountered while conducting Lepidoptera surveys that focus on the entire order is the paucity of taxonomic expertise to provide determinations of the samples, particularly for Microlepidoptera. While species names are not vital for compiling an inventory and estimating species richness, they are extremely useful. We found that the morphospecies concept of identification was inadequate for determining the number of species because of the similarity of many Microlepidoptera, especially Gelechioidea. Although we received considerable assistance from many taxonomists, because of the large number of specimens, it was impossible to obtain determinations of all the material. We suspect that our blacklight samples may include 5-10% more species that, when identified, will be "new" to the inventory.

Conservation Context

Although we cannot assume that any of the species documented on the Station are restricted to sensitive coastal sage scrub habitat, it is highly likely that most contribute to the functioning of the larger biotic landscape, which includes coastal sage scrub, through pollination, herbivory, or as prey. There is little doubt that Lepidoptera phenology (e.g., timing of larval availability as a food source for birds and small mammals) and density (e.g., amount of prey resources available for predators and the amount of herbivore pressure on plants) play a major role in determining the success or failure of many biotic functions of the community.

From a conservation perspective, what sort of information can be extracted from the Lepidoptera survey of MCAS Miramar? While there are numerous ways of examining biotic complexity or ecosystem health, we focus on three criteria that may be useful in assessing the potential conservation value of any site using Lepidoptera: (1) presence of endemics or rare taxa; (2) presence of "weedy" species; (3) and species richness and complementarity.

The presence of numerous "regional endemic" species (e.g., *Lycaena hermes*, *Decodes helix* Powell & Brown, *Eucosma williamsi* Powell, *Crambidia dusca* Barnes & McDunnough, and numerous undescribed species discussed

above) indicates that there probably is considerable native habitat on the Station that is still intact, and that the general area supports biological resources of "regional" significance. Although none of these species is listed as threatened or endangered, and none is restricted to the Station, there may be few other places in southern California where as many co-occur. Hence the Station may support an "assemblage" of regional endemics that exceeds that found at other coastal southern California localities. The occurrence of assemblages of rare species is a common phenomenon wherever rare or depleted native habitats are present. For example, vernal pools throughout the Central Valley of California support numerous plant species listed (or as candidates for listing) as rare, threatened, or endangered, plus one or more species of "sensitive" fairy shrimp (Anostraca) and at least one "sensitive" amphibian.

The abundance of several widespread, weedy species, including *Spodoptera exigua*, *Pseudaletia unipuncta* (Haworth), *Agrotis ypsilon* (all Noctuidae), *Cnephasia longana* (Tortricidae), and others indicates the presence of disturbed or degraded habitat. While occurrence of these species can be explained in part by the adjacency of urbanization, there is little doubt that resident populations of these polyphagous "pests" are present in degraded habitat on the Station. It is likely that the native Lepidoptera fauna has suffered from the introduction of invasive weeds that serve as host plants for weedy moth species. On the other hand, numerous weedy species common in adjacent disturbed and/or urban areas are not present on the Station, or are present in exceedingly low density. For example, *Trichoplusia ni* (Hübner), *Spodoptera ornithogalli* (Guenée), *Peridroma saucia* (Hübner) (all Noctuidae), *Platynota stultana* (Walsingham), *Crocidosema plebejana* Zeller (both Tortricidae), and *Cadra cautella* (Walker) (Pyralidae) are common or abundant in adjacent urbanized and disturbed areas, but were uncommon or rare on the Station. Monitoring strategies capable of detecting changes in the abundance of these weedy species may provide insight into the affects of future environmental change and/or habitat perturbation on the Station.

While the preservation of maximum biodiversity may seem intimately linked with the preservation of areas of highest species richness, this may not always be the case. Areas of highest species richness may represent areas of greatest range overlap of common or widespread species. The number of common, weedy species in an urban area may exceed the number of native species in a depauperate, unique native habitat. Hence the total number of species alone may say little about the overall conservation value of a site or region. Other factors adding to the complexity of using species richness as a measure of conservation value are differences in sampling strategies leading to the richness numbers being compared, or the absence of comparative numbers altogether. For the Lepidoptera of MCAS Miramar, neither average species richness derived from the three methods of extrapolation (n = 715) nor the documented value (n = 646) provide useful conservation information because there are no other numbers to compare, i.e., no other sites in California of this size have been surveyed as thoroughly.

An alternative to focusing conservation efforts on areas of high biodiversity

is to focus on landscape diversity and site complementarity. Maximizing conservation of the greatest variety of habitats, plant communities, slopes, exposures, etc. almost certainly will lead to the preservation of the greatest number of species. Evaluating site complementarity, likewise, may help identify scenarios that capture the greatest number of species. For example, areas of gabbro-derived or serpentine soils typically support exceedingly depauperate floras because the unusually high magnesium and iron content of the soil inhibits the growth of most plant species (Kruckeberg 1954, 1969). Consequently, these areas would receive little or no consideration in conservation efforts focused on areas of high diversity. However, these soils typically support an endemic flora (Raven & Axelrod 1978) that has exceedingly high conservation value. Under a strategy of conserving landscape diversity and areas with high complementarity, these unique areas would receive attention comparable to areas of high species richness. Just as high species richness may not always be an indication of high conservation value, high complementarity, likewise, may lead to conservation decisions that are not optimal for maximizing the preservation of biodiversity. For high complementarity to be an effective criterion, it must be the result of high cumulative species richness (the denominator of FS; see Table 2) as well as a low number of shared species. A site that supports only a subset of a more diverse site may have a high complementarity value with a diverse site, but make no contribution to the cumulative species richness.

In summary, Lepidoptera inventories may be used to focus conservation efforts towards areas of endemism (e.g., areas that support assemblages of regional endemics) and away from areas that support an abundance of weedy species. Species richness, per se, may be of little assistance in assessing conservation value, but a landscape approach that evaluates site complementarity may be highly useful in capturing the greatest species richness.

The growth of conservation biology and concern for the biological consequences of environmental change has stimulated a new and intense interest in ecological monitoring. However, before the results of monitoring programs can be interpreted, a baseline inventory is absolutely vital. We believe that the results of this inventory of MCAS Miramar represent a baseline against which changes in the Lepidoptera fauna of the Station can be measured.

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Literature Cited

Brown, J. W. & P. A. Opler. 1990. Patterns of butterfly species density in peninsular Florida. J. Biogeogr. 17: 615-622.

Chao, A. 1984. Non-parametric estimation of the number of classes in a population. Scand. J. Stat. 11: 265-270.

Colwell, R. K. & J. A. Coddington. 1994. Estimating terrestrial biodiversity through extrapolation. Phil. Trans. Roy. Soc. London B 345: 101-118.

Ehrlich, P. R. 1990. Habitats in crises: Why we should care about the loss of species. For. Ecol. Mangmt. 35:5-11.

Eyre, M. D. & S. P. Rushton. 1989. Quantification of conservation criteria using invertebrates. J. Appl. Ecol. 26: 159-171.

Hodges, R., *et al.* 1983. Check list of the Lepidoptera of America north of Mexico. E. W. Classey & The Wedge Entomol. Res. Found., London.

Howarth, F. G. & G. W. Ramsey. 1991. The conservation of island insects and their habitats, pp. 71-107. *In*: Collins, N. M. & J. A. Thomas (eds.), Conservation of insects and their habitats. Academy Press, London.

Kempton, R. & L. Taylor. 1974. Log-series and log-normal parameters as diversity discriminants for the Lepidoptera. J. Anim. Ecol. 43: 381-399.

Kremen, C., R. K. Colwell, T. L. Erwin, D. D. Murphy, R. F. Noss & M. A. Sanjayan. 1993. Terrestrial arthropod assemblages: their use in conservation planning. Conserv. Biol.7: 796-808.

Kruckeberg, A. R. 1954. The plant species in relation to serpentine soils. Ecology 33: 267-274.

——. 1969. Soil diversity and the distribution of plants, with examples from western North America. Madroño 20: 129-154.

Merritt, R. & K. Cummings (eds.). 1978. An introduction to the aquatic insects of North America. Kendall/Hunt Publ. Co., Dubuque, Iowa. 441 pp.

Murphy, D. & S. Weiss. 1988a. Ecological studies and the conservation of the Bay checkerspot butterfly, *Euphydryas editha bayensis*. Biol. Conserv. 46: 183-200.

——. 1988b. A long-term monitoring plan for a threatened butterfly. Conserv. Biol. 2: 367-374.

——. 1991. Monitoring the effects of regional climate change on biological diversity. Science in Glacier National Park 1990: 4-6.

New, T. R. 1998. Invertebrate surveys for conservation. Oxford University Press, London.

Noss, R. F. & A. Y. Cooperrider. 1994. Saving nature's legacy: protecting and restoring biodiversity. Island Press, Washington, D.C.

Oliver, I. & A. J. Beattie. 1994. A possible method for the rapid assessment of biodiversity, pp. 133-137. *In*: Forey, P. L., C. J. Humphreys & R. I. Vane-Wright (eds.), Systematics and conservation evalutation. Clarendon Press, Oxford, UK.

Panzer, R. & M. W. Schwartz. 1998. Effectiveness of a vegetation-based approach to insect conservation. Conserv. Biol. 12: 693-702.

Pollard, E. 1979. Population ecology and change in range of the white admiral butterfly, *Lagoa camilla* L., in England. Ecol. Entomol. 4: 61-74.

Povolny, D. 1998. New taxa and faunistic records of the tribe Gnorimoschemini from the Nearctic Region (Lepidoptera, Gelechiidae). Stapfia 55: 327-347.

Powell, J. A. 1995. Lepidoptera inventories in the continental United States, pp. 168-170. *In*: LaRoe, E., G. Farris, C. Puckett, P. Doran & M. Mac (eds.), Our Living Resources. U.S. Dept. Interior.

——. 1997. Occurrence of the Palaearctic moth, *Cnephasia longana* (Tortricidae), on Santa Rosa Island, California. J. Lepid. Soc. 51: 93-94.

Powell, J. A. & J. W. Brown. 1998. A new Ericaceae-feeding *Decodes* from the Channel Islands and mainland of southern California. Pan-Pacif. Entomol. 74: 102-107.

Raven, P. H. & D. I. Axelrod. 1978. Origin and relationships of the California flora. Univ. Calif. Publ. Bot. 72. 134 pp.

Razowski, J. 1985. Changes in the Lepidoptera fauna of Cracow, Poland. Nota Lepid. 8: 65-68.

Rubinoff, D. 1998. Field observations on mating behavior and predation of *Hemileuca electra* (Saturniidae). J. Lepid. Soc. 52: 212-213.

Scott, J. M., F. Davis, B. Csuti, R. Noss, B. Butterfield, G. Craig, H. Anderson, S. Caiccoco, F. D'erchia, T. C. Edwards, Jr., J. Ulliman & R. G. Wright. 1993. Gap analysis: a geographic approach to protection of biological diversity. Wildlife Monographs 123.

Southwood, T. R. E., V. K. Brown & P. M. Reader. 1979. The relationship of plant and insect diversities in succession. J. Biol. Linn. 12: 327-348.

Sutton, S. L. & N. M. Collins. 1991. Insect and tropical forest conservation, pp. 405-424. *In*: Collins, N. M. & J. A. Thomas (eds.), Conservation of insects and their habitats. Academy Press, London.

Taylor, L., R. Kempton & I. Wiowod. 1978. The Rothamsted insect survey and the urbanization of land in Great Britain, pp. 31-65. *In*: Frankie, G. & C. Kohler (eds.), Perspectives in urban entomology. Academic Press, New York.

Thomas, A. W. & G. M. Thomas. 1994. Sampling strategies for estimating moth species diversity using a flight trap in a northeastern softwood forest. J. Lepid. Soc. 48: 85-105.

APPENDIX A. Adult flight period for Lepidoptera based on capture records and observations; months abbreviated by capital letters; + = observed or captured, - = not observed.

Months	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Nepticulidae												
Stigmella (?) sp. 1	-	-	-	-	-	-	-	-	-	+	-	-
Stigmella (?) sp. 2	-	-	-	-	-	-	-	+	-	-	-	-
Stigmella (?) sp. 3	-	-	-	+	-	-	-	-	-	-	-	-
Opostegidae												
Opostega bistriguella Braun	+	-	+	+	-	-	-	-	-	-	-	-
Opostega sp.	-	-	-	-	-	-	-	-	-	-	+	-
Tischeriidae												
Tischeria sp.	-	-	-	-	-	-	-	-	-	-	+	-
Incurvariidae												
Lampronia sp.	+	-	-	-	-	-	-	-	-	-	-	-
Adela flammeusella Chambers	-	-	-	+	-	-	-	-	-	-	-	-
Prodoxidae												
Greya sp.	-	-	+	-	-	-	-	-	-	-	-	-
Tegeticula maculata (Riley)	-	-	-	+	-	-	-	-	-	-	-	-
Tegeticula yuccasella (Riley)	-	-	+	+	+	-	-	-	-	-	-	-
Prodoxus marginatus Riley	-	-	+	+	+	-	-	-	-	-	-	-
Prodoxus cinereus Riley	-	-	+	+	+	-	-	-	-	-	-	-
Prodoxus aenescens Riley	-	-	+	+	-	-	-	-	-	-	-	-
Acrolophidae												
Cephitinea obscurostrigella (Ch.)	-	-	+	+	-	+	+	+	+	-	+	-
Amydria arizonella Dietz	-	-	-	+	-	-	-	+	-	-	-	-
Amydria curvistrigella (Dietz)	-	+	+	+	+	+	+	-	-	-	+	+
Amydria confusella Dietz	+	+	+	+	-	-	+	+	-	+	+	-
Amydria obliquella Dietz	-	-	-	-	+	+	+	+	+	+	-	-
Amydria erecta (Braun)	-	-	-	-	+	+	+	+	+	+	-	-
Amydria n. sp.	-	-	-	-	+	-	-	-	-	-	-	-
Amydria sp (dark)	-	-	-	+	+	+	+	+	+	-	-	-
Acrolophus kearfotti (Dyar)	-	-	-	-	-	+	+	+	+	-	-	-
Acrolophus laticapitanus	-	-	-	+	+	+	+	+	+	-	-	-
Acrolophus pyramellus (B. & McD.)	-	-	-	+	+	+	+	+	+	+	-	-
Acrolophus variabilis (Wals.)	-	-	-	-	-	+	+	+	+	-	-	-
Tineidae												
Tinea occidentalis Chambers	+	-	+	+	+	+	+	+	+	+	+	-
Opogona sp. 1	-	-	+	-	-	+	-	+	+	+	+	-
Opogona sp. 2	-	-	-	-	-	+	-	-	-	-	-	-
Opogona omoscopa (Meyrick)	-	-	+	-	-	-	-	-	-	-	-	-
Dryadaula terpsichorella (Busck)	-	-	-	-	-	-	+	-	-	-	-	-
ca. 2 undetermined Tineidae												

Months	J	F	M	A	M	J	J	A	S	O	N	D
Bucculatricidae												
Paraleucoptera sp.	-	-	+	-	-	-	-	-	+	-	-	-
Bucculatrix sp.	+	-	+	-	+	-	-	+	+	-	+	-
Gracillariidae												
Caloptilia sp. 1	-	-	-	-	-	-	-	-	-	+	-	-
Caloptilia sp. 2	-	-	-	-	-	-	-	-	+	-	-	-
Caloptilia sp. 3	-	-	+	-	-	-	-	-	-	-	-	-
Caloptilia sp. 4	-	-	+	-	-	-	-	-	-	-	-	-
ca. 2 undetermined Gracillariidae												
Oecophoridae												
Ethmia arctostaphylella (Wals.)	-	+	+	+	-	+	-	-	-	-	-	-
Ethmia discostrigella (Chambers)	-	+	+	+	+	+	+	+	+	+	-	-
Inga concorella (Beutenmuller)	-	-	-	-	-	+	-	-	-	-	-	-
Pleurota albastrigulella (Kearf.)	-	-	+	+	+	-	-	-	-	-	-	-
ca. 2 undetermined Oecophoridae												
Elachistidae												
Coelopoeta glutinosi Walsingham	-	-	-	-	-	-	-	+	-	-	-	-
Elachista coniophora Braun	+	+	+	+	-	-	-	-	-	-	-	+
Elachista lurida Kaila	-	-	+	-	-	-	-	-	-	-	-	-
Blastobasidae												
Symmoca signatella (H.-S.)	-	-	-	-	+	-	-	-	-	-	-	-
Holcocera gigantella Chambers	+	+	+	-	+	+	+	+	+	+	+	+
Holcocera n. sp. 1	-	-	+	+	+	-	-	-	-	-	+	-
Holcocera n. sp. 2	-	-	-	-	-	+	+	-	-	-	-	-
Hypatopa interpunctella (Dietz)	-	-	+	+	+	-	-	-	+	-	+	-
Hypatopa n. sp. 1	-	-	-	-	+	+	-	-	-	-	-	-
Hypatopa n. sp. 2	-	-	-	-	-	+	-	-	-	-	-	-
Hypatopa n. sp. 3	-	-	-	+	-	-	-	-	-	-	-	-
Hypatopa n. sp. 4	-	-	+	+	+	-	+	-	+	-	+	-
Blastobasis n. sp. 1	-	-	-	-	-	-	+	-	-	-	-	-
Blastobasis n. sp. 2	-	-	-	-	-	-	-	+	-	-	-	-
Blastobasis n. sp. 3	-	-	-	+	-	+	+	+	-	-	-	-
Coleophoridae												
Coleophora accordella Wlsm.	-	-	-	+	-	+	-	-	-	-	+	-
Coleophora sp. 2	+	+	+	-	-	-	-	-	-	-	-	-
Coleophora sp. 3	+	+	+	-	-	-	-	-	-	-	-	-
Coleophora sp. 4	-	-	-	-	+	+	+	-	-	-	-	-
Coleophora sp. 5	-	+	+	-	-	-	-	-	-	-	-	-
Coleophora sp. 6	+	+	+	-	-	-	-	-	-	-	-	-
ca. 5 undetermined sp.												
Momphidae												
Mompha eloisella (Clemens)	-	-	-	-	-	+	+	+	-	-	-	-
Mompha sp.	-	-	-	-	-	-	-	-	+	-	-	-

Months	J	F	M	A	M	J	J	A	S	O	N	D
Cosmopterigidae												
Antequera acertella (Busck)	+	-	-	-	-	-	-	-	-	-	+	+
Cosmopterix sp.	-	-	-	-	-	-	+	-	-	-	-	-
Stagmatophora iridella Busck	-	-	-	-	-	+	+	+	-	-	-	-
Stagmatophora enchrysa (Hodg.)	-	-	-	-	-	+	+	+	-	-	-	-
Pyroderces sp.	-	-	-	-	-	-	-	-	-	-	+	-
Anoncia sp. 1	-	-	-	-	+	+	+	-	-	-	-	-
Anoncia sp. 2	-	-	-	-	-	-	+	-	-	-	-	-
Stilbosis sp.	-	-	-	-	-	-	+	+	+	-	-	-
Walshia miscecolorella	-	-	+	+	+	-	+	-	+	+	+	+
ca. 2 undetermined Cosmopterigidae												
Scythrididae												
Scythris sp. 1	-	-	-	+	+	+	+	+	+	+	+	-
Scythris sp. 2	-	-	-	+	+	+	+	+	+	+	+	-
Scythris sp. 3	-	-	-	-	-	-	-	-	-	+	-	-
Gelechiidae												
Isophrictis sp.	-	-	-	-	-	-	-	+	+	+	-	-
Aristotelia elegantella (Cham.)	-	-	-	+	+	+	+	+	+	+	+	-
Aristotelia sp. 1 (tan)	-	-	+	+	+	+	+	-	+	+	+	-
Aristotelia sp. 2 (rust)	+	+	+	-	+	-	+	+	+	-	+	-
Exotelia californica (Busck)	-	-	+	-	+	-	-	-	-	-	-	-
Exotelia graphicella (Busck)	-	-	-	-	+	-	+	-	-	-	-	-
Leucogoniella californica (Keifer)	-	-	-	+	+	+	+	+	-	-	-	-
Telphusa sedulitella (Busck)	-	-	-	-	+	-	+	-	+	-	-	-
Pseudochellaria scabrella (Busck)	+	+	+	+	+	+	+	+	+	+	+	+
Teleiopsis baldiana (Bar. & Bus.)	-	-	-	-	+	-	-	-	-	-	-	-
Gelechia sp. 1	-	-	-	+	-	-	-	-	-	-	-	-
Gnorimoschema powelli Povolny	-	-	-	+	-	-	-	-	-	-	-	-
Gnorimoschema sp. 1	-	-	-	-	+	-	-	-	-	-	-	-
Gnorimoschema saphirinella (Ch.)	-	-	-	-	-	-	-	+	-	-	-	-
Chionodes figurella (Busck)	-	-	-	-	+	-	-	-	-	-	-	-
Chionodes notandella (Busck)	+	+	-	-	-	-	-	-	-	-	-	+
Chionodes ochreostrigella (Cham.)	-	-	-	-	-	-	-	-	+	-	-	-
Chionodes sp. 1	-	-	-	+	-	-	-	-	-	-	-	-
Chionodes sp. 2	-	-	-	-	+	-	-	-	-	-	-	-
Chionodes sp. 3	+	-	-	-	-	-	-	-	-	-	-	-
Chionodes sp. 4	-	-	-	+	-	-	-	-	-	-	-	-
Chionodes sp. 5	-	+	-	-	-	-	-	-	-	-	-	-
Filatima sp. 1	+	-	-	-	-	-	-	-	-	-	-	-
Filatima sp. 2	-	+	-	-	-	-	-	-	-	-	-	-
Aroga morenella (Busck)	-	-	-	+	+	+	+	-	-	-	-	-
Anacampsis lacteusochrella (Ch.)	-	-	-	-	+	-	-	-	-	-	-	-
Dichomeris baxa Hodges	-	+	-	-	+	+	-	-	-	-	-	-
Metopleura potosi Busck	-	-	-	+	+	+	+	+	+	-	-	-
Gelechiidae sp. 1	-	-	-	-	-	-	-	-	-	+	-	-
Gelechiidae sp. 2	-	-	-	-	-	-	-	-	-	+	-	-
Gelechiidae sp. 3	+	-	-	-	+	-	-	-	-	-	-	-

Months	J	F	M	A	M	J	J	A	S	O	N	D
Gelechiidae sp. 4	+	-	-	-	+	-	-	-	-	-	-	-
ca. 22 undetermined Gelechiidae												
Alucitidae												
Alucita hexadactylon L.	-	-	-	+	-	-	-	-	-	-	-	-
Carposinidae												
Bondia comonana (Kearfott)	-	-	-	-	-	-	-	-	-	-	+	-
Plutellidae												
Euceratia securella Walsingham	-	-	+	+	-	-	-	-	-	-	-	-
Pliniaca bakerella Busck	-	-	+	+	-	-	-	-	-	-	-	-
Plutella albidorsella (Wals.)	-	-	-	-	+	-	-	-	-	-	-	-
Plutella xylostella (L.)	-	-	+	-	-	-	-	-	-	-	+	-
Plutella sp. (tan)	-	-	-	-	+	-	-	-	-	-	-	-
Ypsolopha cervella (Walsingham)	-	-	-	-	+	-	-	-	-	-	-	-
Yponomeutidae												
Zelleria sp. (?)	+	+	-	-	-	-	-	-	-	-	-	+
Sesiidae												
Paranthrene robinae (Edwards)	-	-	-	+	-	-	-	-	-	-	-	-
Synanthedon polygoni (Edwards)	-	-	-	+	+	-	-	-	-	-	-	-
Synanthedon resplendens (Edw.)	-	-	-	-	-	+	+	-	-	-	-	-
Synanthedon exitiosa (Say)	-	-	-	-	+	+	-	-	-	-	-	-
Penstemonia hennei Engelhard	-	-	-	-	-	+	+	+	-	-	-	-
Cossidae												
Prionoxystus robiniae (Peck)	-	-	-	-	+	-	-	-	-	-	-	-
Tortricidae												
Episimus argutanus (Clemens)	-	-	+	+	+	+	-	-	+	-	-	-
Bactra furfurana (Haworth)	-	-	-	+	-	+	-	-	-	-	-	-
Bactra verutana Zeller	-	+	+	+	+	+	+	+	+	+	+	+
Bactra priapeia Heinrich	-	-	-	-	-	-	+	-	-	-	-	-
Endothenia hebesana (Walker)	-	-	-	+	-	-	-	-	-	-	-	+
Endothenia nubilana (Clemens)	-	-	-	-	-	+	+	+	+	-	-	+
Rhyacionia frustrana (Comstock)	-	-	-	-	-	-	-	+	+	-	-	-
Phaneta apacheana (Wals.)	+	+	+	-	+	-	+	+	-	-	-	-
Phaneta misturana (Heinrich)	-	+	+	-	-	-	-	-	-	-	-	-
Phaneta pallidarcis (Heinrich)	-	-	-	-	+	+	+	+	+	-	-	-
Phaneta subminimana (Heinrich)	-	-	-	-	-	+	+	+	+	-	-	-
Phaneta sp. (brown)	+	-	-	-	-	-	-	-	-	-	-	-
Eucosma ridingsana (Robinson)	-	-	-	-	-	-	-	+	+	-	-	-
Eucosma sandiego Kearfott	-	-	-	-	-	-	-	+	+	+	-	-
Eucosma n. sp. (nr. *hazelana*)	-	-	-	-	-	-	+	+	-	-	-	-
Eucosma costastrigulana Kearfott	-	-	-	+	+	+	+	+	+	-	-	-
Eucosma williamsi Powell	-	-	-	-	-	+	+	+	+	+	-	-
Eucosma pulveratana (Wals.)	+	+	+	+	+	+	+	+	+	+	+	+

Months	J	F	M	A	M	J	J	A	S	O	N	D
Eucosma nr. *passerana* (Wals.)	-	-	-	-	-	-	+	-	+	-	-	-
Eucosma sp. 1	-	-	-	-	-	-	-	+	+	-	-	-
Eucosma sp. 2	-	-	-	-	-	-	-	-	-	+	-	-
Epiblema strenuana (Walker)	-	-	-	-	-	+	-	-	-	-	-	-
Suleima lagopana (Walsingham)	-	-	-	-	+	-	-	-	-	-	-	-
Sonia filiana (Busck)	-	-	-	-	-	-	-	-	+	+	+	-
Pseudexentra habrosana (Heinrich)	-	+	+	-	-	-	-	-	-	-	-	-
Chimoptesis chrysopyla Powell	-	+	-	-	-	-	-	-	-	-	-	-
Crocidosema plebejana Zeller	-	-	-	-	-	-	+	-	-	-	+	-
Epinotia siskiyouana Heinrich	-	-	-	-	-	+	-	+	-	-	-	-
Epinotia subplicana (Wals.)	-	-	+	-	-	-	-	-	-	-	-	-
Epinotia sagittana McDunnough	-	-	-	-	-	-	-	-	-	-	+	-
Epinotia columbia (Kearfott)	+	-	-	-	-	+	-	-	-	-	+	-
Epinotia bigemina Heinrich	+	-	-	-	-	-	-	-	-	-	+	+
Epinotia kasloana McDunnough	+	+	-	-	-	-	-	-	-	-	-	+
Epinotia signiferana Heinrich	+	-	-	-	-	-	-	-	-	-	+	+
Epinotia n. sp.	-	+	+	-	-	-	-	-	-	-	-	-
Ancylis nr. *simuloides* (McD.)	+	+	+	-	-	+	-	-	-	-	-	+
Ancylis mediofasciana (Clemens)	-	+	+	-	-	-	-	-	-	-	-	-
Cydia latiferreanus (Wals.)	-	-	-	-	-	-	+	+	+	+	-	-
undet. Olethreutinae sp. 3	-	-	-	+	-	-	-	+	-	-	-	-
undet. Olethreutinae sp. 4	-	-	-	+	-	-	-	-	-	-	-	-
Acleris senescens (Zeller)	-	+	-	-	-	-	-	-	-	-	-	-
Acleris foliana (Walsingham)	-	-	-	-	+	+	-	-	-	-	-	-
Cnephasia longana (Haworth)	-	-	-	+	+	+	-	-	-	-	+	-
Decodes fragarianus (Busck)	-	-	-	-	-	-	-	-	+	+	+	-
Decodes asapheus Powell	-	-	-	-	-	-	-	-	-	-	+	-
Decodes helix Powell & Brown	+	+	+	-	-	-	-	-	-	-	+	+
Anopina triangulana (Kearfott)	-	-	-	+	+	-	+	-	-	+	-	-
Argyrotaenia niscana (Kearfott)	-	-	+	+	+	+	-	-	-	-	-	-
Argyrotaenia franciscana (Wlsm.)	+	+	+	+	+	+	+	-	+	-	-	+
Archips argyrospila (Walker)	-	-	-	+	+	+	-	-	-	-	-	-
Clepsis peritana (Clemens)	-	-	+	+	-	-	+	+	+	-	+	-
Sparganothis senecionana (Wlsm.)	-	-	-	+	+	+	-	-	-	-	-	-
Platynota stultana (Walsingham)	-	-	-	-	-	-	+	+	+	-	-	-
Amorbia cuneana (Walsingham)	+	+	+	+	+	+	+	+	+	+	+	+
Henricus umbrabasanus (Kearfott)	-	-	-	-	+	+	+	+	+	-	-	-
Lorita scarificata Meyrick	+	-	+	-	-	-	-	-	+	+	-	-
Cochylis carmelana Kearfott	-	-	-	+	-	-	-	-	-	-	-	-
Saphenista (?) sp. 1	-	-	-	-	-	+	-	+	+	-	-	-
Saphenista (?) sp. 2	-	-	-	-	-	-	-	+	+	-	-	-
Saphenista (?) sp. 3	-	-	-	-	-	-	-	+	+	-	-	-
Hesperiidae												
Erynnis tristis (Boisduval)	-	-	-	-	-	+	+	+	-	-	-	-
Erynnis funeralis (Scud. & Burg.)	-	+	+	+	+	+	-	-	-	-	-	-
Pyrgus albescens Plotz	-	-	-	+	+	+	-	+	-	-	-	-
Heliopetes ericetorum (Boisduval)	-	-	-	-	-	+	-	-	-	-	-	-
Hylephila phyleus (Drury)	-	-	-	+	+	-	-	+	+	-	-	-

Months	J	F	M	A	M	J	J	A	S	O	N	D
Atalopedes campestris (Boisduval)	-	-	-	-	-	-	-	-	-	+	-	-
Ochlodes agricola (Boisduval)	-	-	-	+	+	+	-	-	-	-	-	-
Ochlodes sylvanoides (Boisduval)	-	-	-	-	-	-	-	+	+	-	-	-
Poanes melane (Edwards)	-	-	-	+	-	-	-	-	+	-	-	-
Lerodea eufala (Edwards)	-	-	-	-	-	-	-	-	+	-	-	-
Papilionidae												
Papilio zelicaon Lucas	-	+	+	+	+	-	-	-	-	-	-	-
Papilio cresphontes Cramer[1]	-	-	-	-	-	+	-	-	-	-	-	-
Papilio rutulus Lucas	-	-	+	+	+	+	+	+	-	-	-	-
Papilio eurymedon Lucas	-	-	-	+	+	+	-	-	-	-	-	-
Pieridae												
Pontia protodice (Bois. & LeCon.)	-	-	-	+	+	+	+	-	-	-	-	-
Pieris rapae (L.)	-	-	+	+	+	+	-	+	+	-	-	-
Anthocharis sara Lucas	-	-	+	+	+	-	-	-	-	-	-	-
Colias eurytheme Boisduval	-	+	-	-	-	-	-	-	-	+	-	-
Colias eurydice Boisduval[1]	-	-	-	-	-	+	-	-	-	-	-	-
Phoebis sennae (L.)	-	-	+	-	-	-	-	-	-	-	-	-
Nathalis iole Boisduval	-	-	-	-	+	-	-	-	-	-	-	-
Lycaenidae												
Lycaena hermes (Edwards)	-	-	-	-	+	+	-	-	-	-	-	-
Satyrium sylvinum (Boisduval)	-	-	-	-	-	+	-	-	-	-	-	-
Satyrium tetra (Edwards)	-	-	-	-	+	-	-	-	-	-	-	-
Satyrium saepium (Boisduval)	-	-	-	-	+	+	+	-	-	-	-	-
Callophrys dumetorum (Bois.)	-	+	+	+	-	-	-	-	-	-	-	-
Incisalia augustinus (Kirby)	-	-	+	+	-	-	-	-	-	-	-	-
Strymon melinus Hübner	-	+	+	-	+	-	-	-	+	-	-	-
Brephidium exile (Boisduval)	-	+	+	-	-	-	-	-	+	-	-	-
Leptotes marina (Reakirt)	-	-	+	-	-	+	-	-	-	-	-	-
Celastrina ladon (Cramer)	-	-	+	+	+	-	-	-	-	-	-	-
Philotes sonorensis (Feld. & Feld.)	-	-	+	-	-	-	-	-	-	-	-	-
Euphilotes bernardino (B. & McD.)	-	-	-	-	+	+	+	-	-	-	-	-
Glaucopsyche lygdamus (Doubl.)	-	+	+	+	-	-	-	-	-	-	-	-
Icaricia acmon (West. & Hew.)	-	-	+	+	+	-	-	-	+	-	-	-
Riodinidae												
Apodemia mormo (Feld. & Feld.)	-	+	+	+	+	+	+	+	+	+	-	-
Nymphalidae												
Agraulis vanillae (L.)	-	-	-	-	-	-	-	-	-	+	-	-
Nymphalis antiopa (L.)	-	-	-	-	+	-	-	-	-	-	-	-
Vanessa viginiensis (Drury)	-	+	-	-	-	-	-	-	-	-	-	-
Vanessa cardui (L.)	+	+	+	+	+	-	-	-	-	+	-	-
Vanessa annabella (L.)	-	-	+	-	-	-	-	-	-	-	-	-
Vanessa atalanta (L.)	-	-	-	+	-	-	-	-	-	-	-	-
Junonia coenia (Hübner)	-	-	+	+	+	+	+	-	+	+	-	-
Speyeria callippe (Boisduval)	-	-	-	+	+	+	-	-	-	-	-	-

Months	J	F	M	A	M	J	J	A	S	O	N	D
Chlosyne gabbii (Behr)	-	-	-	+	+	-	-	-	-	-	-	-
Euphydryas chalcedona (Doubl.)	-	-	-	+	+	-	-	-	-	-	-	-
Limenitis lorquini (Boisduval)	-	-	+	+	-	+	-	-	-	+	-	-
Adelpha bredowii (Geyer)	-	-	+	+	+	-	-	+	-	-	-	-
Coenonympha tullia Westwood	-	+	+	+	+	+	+	-	-	-	-	-
Danaus plexippus (L.)	-	+	+	+	-	+	-	+	+	-	-	-
Danaus gilippus (Cramer)[1]	-	-	-	-	-	+	-	-	-	-	-	-
Limacodiae												
Monoleuca occidentalis B. & McD.	-	-	-	-	-	+	+	+	+	+	-	-
Crambidae												
Scoparia palloralis Dyar	-	+	+	+	-	-	-	-	-	-	-	-
Eudonia rectilinea (Zeller)	-	-	+	+	+	+	-	-	-	-	-	-
Eudonia spenceri Munroe	-	-	-	-	+	-	-	-	-	-	-	-
Usingeriessa brunnidalis (Dyar)	-	-	-	-	-	-	-	+	-	-	-	-
Petrophila jaliscalis (Schaus)	-	-	-	-	-	-	-	-	-	+	-	-
Microtheoris ophionalis (Walker)	-	-	-	-	-	+	+	+	+	+	-	-
Nannobotys commortalis (Grote)	-	-	-	+	-	-	-	-	-	-	-	-
Mimoschinia rufofascialis (Steph.)	-	-	-	+	+	-	-	-	-	-	-	-
Hellula rogatalis (Hulst)	-	-	+	+	+	+	+	+	+	+	+	+
Stegea powelli Munroe	-	-	-	-	-	+	+	+	+	-	-	-
Abegesta reluctalis (Hulst)	-	-	-	-	-	-	+	+	+	-	-	-
Lipocosma albibasalis B. & McD.	-	-	-	+	+	+	+	+	+	+	+	-
Dicymolomia metalliferalis (Pack.)	-	-	-	+	+	+	+	+	+	-	-	-
Achyra occidentalis (Packard)	-	-	+	+	-	-	-	-	-	+	+	-
Pyrausta napaealis (Hulst)	-	-	+	+	-	-	-	-	-	-	-	-
Pyrausta nr. *roseivestalis* Mun.	-	-	+	-	-	-	-	-	-	-	-	-
Pyrausta pilatealis (B. & McD.)	-	-	-	+	-	-	-	-	-	-	-	-
Pyrausta volupialis (Grote)	-	-	-	+	+	+	-	+	+	+	-	+
Pyrausta morenalis (Dyar)	-	-	-	+	-	-	-	-	-	-	-	-
Pyrausta coccinea Warren	-	-	-	+	-	-	-	-	-	-	-	-
Pyrausta laticlavia (Gr. & Rob.)	-	+	-	+	+	+	+	+	+	+	+	+
Pyrausta fodinalis (Lederer)	-	-	-	-	+	-	-	-	-	-	-	-
Udea profundalis (Packard)	-	-	+	+	-	-	-	-	-	-	-	-
Udea octosignalis (Hulst)	-	-	-	-	+	+	+	-	-	-	-	-
Lamprosema sinaloanensis Dyar	-	-	-	-	+	-	-	-	-	-	-	-
Lineodes integra (Zeller)	-	-	-	-	-	-	-	-	+	+	-	-
Choristostigma elegantalis Warren	-	+	+	+	+	-	-	-	-	-	-	-
Mecyna mustelinalis (Packard)	-	-	+	+	+	+	+	-	-	-	-	-
Mimorista subcostalis Hamp.	-	-	-	-	-	+	-	-	+	-	-	-
Nomophila neartica Munroe	+	+	+	+	-	-	-	-	+	+	+	+
Spoladea recurvalis (Fabricius)	-	-	-	-	-	-	-	-	-	+	-	-
Lygropia octonalis (Zeller)	-	-	-	-	-	-	+	+	-	-	-	-
Diastictis fracturalis (Zeller)	+	-	+	+	+	+	+	+	+	+	+	-
Crambus occidentalis Grote	-	-	-	-	-	-	-	-	-	-	+	-
Crambus rickseckerellus Klots	-	-	-	-	-	-	-	-	-	+	+	-
Crambus cypridalis Hulst	-	-	-	-	+	-	+	-	+	+	-	-
Agriphila undata (Grote)	-	-	-	-	-	-	-	-	-	+	+	-

Months	J	F	M	A	M	J	J	A	S	O	N	D
Agriphila attenuata (Grote)	-	-	-	-	-	-	-	-	+	+	+	-
Agriphila angulata (B. & McD.)	-	-	-	-	+	+	+	+	+	+	+	-
Microcrambus sp. 1	-	-	-	-	-	-	-	-	+	-	-	-
Microcrambus sp. 2	-	-	-	-	-	-	-	-	+	-	-	-
Parapediasia teterrella Zincken	-	-	-	-	-	-	+	+	+	+	-	-
Euchromius californicalis (Pack.)	-	-	+	+	+	+	+	+	+	+	-	-
Hemiplatytes epia (Dyar)	-	-	-	-	-	+	+	+	+	-	-	-
Pyralidae												
Pyralis electalis Hulst	-	-	-	-	-	+	+	+	+	+	-	-
Pyralis cacamica Dyar	-	-	-	+	+	+	+	+	+	+	+	-
Herculia phoezalis Dyar	-	-	-	-	+	+	+	-	-	-	-	-
Acallis gripalis (Hulst)	-	-	-	+	+	+	+	+	+	+	+	+
Arta epicoenalis Ragonot	-	-	-	+	+	+	+	-	+	+	+	-
Jocara trabalis (Grote)	-	-	+	+	+	+	+	+	+	+	+	-
Tallula fieldi Barnes & McD.	-	-	-	-	+	+	-	-	-	-	-	-
Galleria mellonella (Linnaeus)	+	-	-	-	+	-	+	+	+	+	-	-
Achroia grisella (Fabricius)	-	-	-	-	+	-	-	-	-	-	-	-
Macrotheca angulalis B. & McD.	-	-	-	-	-	+	-	-	-	-	-	-
Macrotheca ponda (Dyar)	-	-	-	+	+	+	+	+	+	+	-	-
Rhodophaea caliginella (Hulst)	-	-	-	-	+	+	+	+	+	-	-	-
Myelopsis alatella (Hulst)	-	-	+	+	-	-	-	-	-	-	-	-
Ambesa walsinghami (Ragonot)	-	-	-	-	-	-	+	-	-	-	-	-
Nephopteryx bifasciella Hulst	-	-	-	+	-	+	-	+	+	+	-	-
Sarata pullatella (Ragonot)	+	+	+	-	-	-	-	-	-	-	-	-
Sarata dophnerella Ragonot	-	-	+	-	-	-	-	-	-	-	-	-
Lipographis fenestrella (Packard)	-	-	+	+	-	-	-	-	-	-	-	-
Adelphia ochripunctella (Dyar)	-	-	-	-	-	-	-	-	-	-	+	-
Elasmopalpus lignosellus (Zeller)	-	-	-	-	-	-	-	-	-	-	+	-
Eumysia fuscatella (Hulst)	-	-	-	-	-	-	+	+	+	+	+	-
Honora dotella Dyar	-	-	-	+	-	+	-	+	-	-	-	-
Homeosoma electellum (Hulst)	-	-	-	-	-	-	-	-	-	+	-	-
Homeosoma uncanale Hulst	-	-	-	+	-	-	-	-	-	-	-	-
Phycitodes mucidella (Ragonot)	-	-	-	+	-	+	+	+	+	-	-	-
Laetilia coccidivora (Comstock)	+	+	+	+	-	+	-	+	+	+	+	-
Laetilia zamacrella Dyar	-	-	-	-	-	-	-	+	-	-	-	-
Rhagea stigmella (Dyar)	-	-	+	+	+	+	+	+	+	+	+	+
Olycella subumbrella (Dyar)	-	-	-	-	-	-	-	-	+	-	-	-
Eremberga craebates (Dyar)	-	-	-	-	-	+	-	+	+	+	-	-
Ozamia fuscomaculella (Wright)	-	-	-	-	-	+	+	+	+	+	-	-
Ephestiodes gilvescentella Ragonot	+	+	-	+	-	-	-	-	+	-	-	-
Ephestiodes erythrella Ragonot	-	-	+	-	-	-	-	-	-	-	+	-
Ephestiodes griseus Nuenzig	-	-	+	-	-	-	-	-	-	-	-	-
Manhatta setonella (McD.)	-	-	+	-	-	-	-	-	-	-	-	-
Sosipatra rileyella (Ragonot)	-	-	-	-	+	-	-	-	-	-	-	-
Anagasta kuehniella (Zeller)	-	-	-	+	-	-	-	-	-	-	+	+
Cadra cautella (Walker)	+	-	-	-	-	-	-	-	-	-	-	-
Arivaca albidella (Hulst)	-	-	-	+	+	+	+	-	-	-	-	-

Months	J	F	M	A	M	J	J	A	S	O	N	D
Pterophoridae												
Pterophorus ningoris (Wals.)	-	-	-	+	-	-	-	-	-	-	-	-
Platyptila carduidacyla (Riley)	+	-	-	-	-	-	-	-	-	-	-	-
Anstenoptila marmarodactyla (Dy.)	+	+	-	-	+	-	-	-	-	-	-	-
Stenoptilia zophodactyla (Dup.)	+	-	-	-	-	-	-	-	-	-	-	-
Emmelina monodactyla (L.)	-	+	-	-	-	-	-	-	-	-	-	-
ca. 3 undetermined Pterophoridae												
Geometridae												
Protitame subalbaria (Packard)	-	-	+	-	+	+	+	+	+	-	-	-
Itame quadrilinearia (Packard)	-	-	-	-	+	-	-	-	-	-	-	-
Itame semivolata (Dyar)	-	-	-	-	+	-	-	-	-	-	-	-
Itame extemporata B. & McD.	-	-	-	+	+	+	+	-	-	-	-	-
Itame guenearia (Packard)	-	-	-	+	+	+	+	-	-	-	-	-
Elpiste marcescaria (Guenée)	+	+	+	+	+	+	+	+	+	-	+	+
Elpiste metanemaria (Hulst)	+	+	+	+	+	+	+	+	+	+	+	+
Semiothisa pictipennata (Hulst)	+	-	+	+	+	+	-	+	-	-	+	+
Semiothisa californiaria (Hulst)	-	-	+	+	-	+	+	-	-	-	-	-
Semiothisa neptaria (Guenée)	+	+	-	+	+	+	+	+	+	+	+	-
Semiothisa s-signata (Packard)	-	-	-	-	-	-	-	-	-	-	+	-
Hesperumia sulphurararia Packard	-	-	-	+	+	+	-	-	-	-	-	-
Neoalcis californiaria (Packard)	-	-	-	-	-	-	+	+	+	+	+	+
Glaucina epiphysaria Dyar	+	+	+	+	+	-	-	-	-	-	+	+
Glaucina magnifica Grossbeck	-	-	-	-	-	-	-	-	-	+	+	-
Hulstina exhumata (Swett)	-	-	-	+	+	-	-	-	-	-	-	-
Hulstina wrightiaria (Hulst)	-	-	-	-	+	-	-	-	-	-	-	-
Pterotaea lamiaria (Strecker)	-	-	-	+	+	+	+	-	-	-	-	-
Anacamptodes fragilaria (Gross.)	+	-	-	-	-	-	+	+	+	+	-	-
Cochisea sinuaria B. & McD.	-	-	-	-	-	-	-	-	-	+	+	+
Phigalia plumogeraria (Hulst)	+	+	+	-	-	-	-	-	-	-	-	-
Paleacrita longiciliata Hulst	+	+	-	-	-	-	-	-	-	-	+	+
Lomographa elsinora (Hulst)	-	-	+	+	+	-	-	-	-	-	-	-
Sericosema juturnaria (Guenée)	-	-	-	-	+	+	-	-	-	-	-	-
Eudrepanulatrix rectifascia (Hulst)	+	-	-	-	-	-	-	-	-	-	-	+
Drepanulatrix unicalcaria (Guen.)	+	+	+	+	+	-	-	-	-	-	+	+
Drepanulatrix hulstii (Dyar)	-	-	-	-	-	-	-	-	+	-	-	-
Drepanulatrix bifilata (Hulst)	-	+	+	+	+	-	-	-	-	+	+	-
Drepanulatrix quadraria (Grote)	+	+	+	-	-	-	-	-	-	+	+	+
Drepanulatrix foeminaria (Guen.)	-	+	-	-	-	-	-	-	-	-	+	-
Drepanulatrix carnearia (Hulst)	-	+	-	-	-	-	-	-	-	+	-	-
Drepanulatrix falcataria (Pack.)	+	+	+	-	+	-	-	-	-	-	-	+
Drepanulatrix monicaria (Guen.)	+	+	+	-	-	-	-	-	-	+	+	+
Pero radiosaria (Hulst)	+	+	+	+	+	+	+	+	-	+	+	+
Pero mcdunnoughi (Cass. & Swett)	+	+	+	+	+	+	+	+	+	+	+	+
Aethaloidia packardaria (Hulst)	+	+	+	+	+	+	+	+	+	+	+	+
Parexcelsa ultraria Pearsall	-	-	-	-	-	-	-	+	+	+	+	+
Slossonia rubrotincta Hulst	-	-	-	-	+	+	+	-	-	-	-	-
Sicya laetula Barnes & McD.	-	-	-	+	+	+	-	-	-	-	-	-
Plataea personaria (Edwards)	+	+	+	+	+	+	+	+	+	+	+	+

Months	J	F	M	A	M	J	J	A	S	O	N	D
Eusarca falcata (Packard)	+	+	+	+	+	-	-	-	+	+	-	-
*Somatolopha simpliciana*B. & McD.	-	-	-	-	+	-	-	-	-	-	-	-
Pherne subpunctata (Hulst)	+	+	+	+	+	+	+	+	+	+	+	+
Synaxis hirsutaria Barnes & McD.	-	-	-	-	-	-	-	-	-	+	+	+
Synaxis mosesiani Sala	+	+	+	-	-	-	-	-	-	-	+	-
Prochoerodes truxaliata (Guenée)	+	+	+	+	+	-	-	-	-	+	+	+
Chlorosea banksaria Sperry	-	-	-	+	+	-	-	-	-	-	-	-
Nemoria pulcherrima (B. & McD.)	+	+	-	-	-	-	-	-	-	-	-	-
Nemoria pistaciaria (Packard)	-	-	+	+	+	+	+	-	-	-	-	-
Nemoria darwiniata (Dyar)	+	+	+	+	-	-	+	+	+	+	-	-
Nemoria leptalea Ferguson	-	+	+	+	+	-	+	+	+	+	+	+
Nemoria glaucomarginaria (Barnes & McDunnough)	-	+	+	+	-	+	-	+	-	-	-	-
Dichordia illustraria (Hulst)	+	-	-	-	+	+	-	+	+	+	+	+
Synchlora aerata (Fabricius)	-	-	-	-	-	-	+	+	+	+	-	-
Cheteoscelis faseolaria (Guenée)	+	-	+	+	+	+	+	+	+	+	+	+
Chlorochlamys triangularis Prout	-	-	-	+	+	-	-	-	-	-	-	-
Lobocleta ossularia (Geyer)	-	-	-	-	-	-	-	+	-	-	-	-
Lobocleta granitaria (Packard)	-	-	-	-	-	-	-	-	-	-	-	+
Lobocleta plemyraria (Packard)	-	-	-	-	-	-	-	-	+	-	-	-
Idaea bonifata (Hulst)	-	-	-	-	-	-	-	+	+	+	-	-
Idaea eremiata (Hulst)	-	-	-	-	-	+	+	+	+	-	-	-
Cyclophora dataria (Hulst)	-	+	-	-	+	-	-	-	-	-	-	-
Cyclophora nanaria (Walker)	-	-	-	+	-	-	-	-	+	-	+	+
Dysstroma mancipata (Guenée)	-	-	-	+	+	+	-	-	-	-	-	-
Hydriomena albifasciata (Pack.)	-	+	-	-	-	-	-	-	-	-	-	-
Hydriomena nubilofasciata (Pack.)	-	+	+	-	-	-	-	-	-	-	-	-
Triphosa californiata (Packard)	+	+	+	-	-	-	-	-	-	-	-	-
Archirhoe neomexicana (Hulst)	+	+	+	+	-	-	-	-	-	+	+	+
Perizoma custodiata (Guenée)	-	-	+	-	-	-	-	-	-	-	-	+
Anticlea switzeraria (Wright)	-	-	+	-	-	-	-	-	-	-	-	-
Stamnodes albiapicata Grossbeck	-	+	-	-	-	-	-	-	-	-	-	-
*Stamnodes recksecker*i Pearsall	+	-	-	-	-	-	-	-	-	-	+	+
Stamnodes affiliata Pearsall	+	-	-	-	-	-	-	-	-	-	+	+
Stamnodes annellata (Hulst)	+	+	+	+	-	-	-	-	-	-	-	-
Stamnodes coenonymphata (Hulst)	+	+	+	+	-	-	-	-	-	+	-	-
Stamnodes cassinoi Swett	+	-	-	-	-	-	-	-	-	-	+	+
Epirrhoe plebeculata (Guenée)	-	+	-	-	-	-	-	-	-	-	-	-
Zenophleps lignicolorata (Packard)	+	+	+	+	-	-	-	-	+	+	+	+
Orthonama centrostrigaria (Woll.)	+	-	+	-	-	-	-	-	+	-	-	-
Venusia duodecelimeata (Packard)	-	-	+	+	-	-	-	-	-	-	-	-
Eupithecia maestoma (Hulst)	-	+	+	-	-	-	-	-	-	-	-	-
Eupithecia misturata (Hulst)	+	+	+	-	-	-	-	-	-	-	+	-
Eupithecia rotundopuncta Packard	-	+	-	-	-	-	-	-	-	-	-	-
Eupithecia zelmira Swett & Cass.	-	-	+	-	-	-	-	-	-	-	-	-
Eupithecia acutipennis (Hulst)	+	+	-	-	-	-	-	-	-	-	+	+
Eupithecia shirleyata Cass. & Sw.	-	+	+	-	-	-	-	-	-	-	-	-
Eupithecia nevadata Packard	+	+	+	+	-	-	-	-	-	-	-	-
Nasusina inferior (Hulst)	-	-	-	+	-	-	-	-	-	-	-	-

Months	J	F	M	A	M	J	J	A	S	O	N	D
Nasusina vaporata (Pearsall)	-	-	-	+	-	-	-	-	-	-	-	-
Trichopteryx veritata Pearsall	-	-	+	+	-	-	-	-	-	-	-	-
Lasiocampidae												
Tolype glenwoodi Barnes	-	-	-	-	+	+	+	+	-	-	-	-
Phyllodesma americana (Harris)	-	+	+	+	+	-	-	+	-	-	-	-
Gloveria medusa (Strecker)	-	-	-	-	-	+	+	-	+	+	+	-
Malacosoma constrictum (Edw.)	-	-	-	-	+	+	-	-	-	-	-	-
Saturniidae												
Hemileuca electra (Wright)	-	-	-	-	-	-	-	-	+	+	-	-
Saturnia walterorum Hog. & John.	-	-	+	-	-	-	-	-	-	-	-	-
Antheraea polyphemus (Cramer)	-	-	-	+	-	-	-	-	-	-	-	-
Hyalophora euryalus (Boisduval)	+	+	+	+	-	-	-	-	-	-	-	-
Sphingidae												
Manduca sexta (Linnaeus)	-	-	-	-	-	-	-	-	+	-	-	-
Sphinx perelegans Edwards	-	-	-	+	+	-	+	+	-	-	-	-
Smerinthus cerisyi Kirby	-	-	+	+	-	+	+	+	+	-	-	-
Pachysphinx occidentalis (Edw.)	-	-	-	-	-	-	-	+	-	-	-	-
Erinnyis ello (Linnaeus)	-	-	-	-	-	-	-	+	+	-	-	-
Hemaris diffinis (Boisduval)	-	-	-	-	-	-	+	-	-	-	-	-
Hyles lineata (Fabricius)	-	+	+	+	-	+	+	-	-	+	-	+
Notodontidae												
Clostera apicalis (Walker)	-	+	+	+	+	+	+	+	+	-	-	-
Datana perspicua Gr. & Rob.	-	-	-	-	-	-	-	+	-	-	-	-
Furcula cinerea (Walker)	-	-	-	+	+	-	+	+	+	-	-	-
Furcula scolopendrina (Bois.)	-	-	-	+	+	-	+	+	+	-	-	-
Dioptidae												
Phryganidia californica Packard	-	-	-	+	+	-	-	-	-	-	-	-
Arctiidae												
Crambidia dusca B. & McD.	-	-	-	+	+	+	-	+	+	+	+	-
Cisthene liberomacula (Dyar)	-	-	+	-	+	+	+	+	+	+	+	+
Cisthene deserta (Felder)	-	-	-	+	+	-	+	+	-	-	-	-
Cisthene dorsimacula (Dyar)	-	-	-	+	+	+	+	+	+	+	+	-
Cisthene perrosea (Dyar)	-	-	-	-	+	+	+	-	+	+	-	-
Cisthene faustinula (Boisduval)	-	-	-	-	-	-	-	-	+	-	-	-
Lycomorpha grotei (Packard)	-	-	-	-	-	-	-	-	+	-	-	-
Estigmene acrea (Drury)	-	-	+	-	-	-	-	-	-	-	-	-
Spilosoma vestalis Packard	-	-	+	+	-	-	-	-	-	-	-	-
Arachnis picta Packard	-	-	-	-	-	-	-	-	+	+	+	-
Apantesis hewletti B. & McD	-	-	+	+	+	-	-	-	-	-	-	-
Apantesis nevadensis (Gr. & Rob.)	-	-	-	-	-	-	-	+	+	+	-	-
Apantesis proxima (Guer.-Mene.)	+	+	+	+	+	+	+	+	+	+	+	+
Hemihyalia edwardsii (Packard)	-	-	-	-	-	-	-	-	-	+	-	-
Ctenucha brunnea Stretch	-	-	-	-	-	+	-	-	-	-	-	-

Months	J	F	M	A	M	J	J	A	S	O	N	D
Lymantriidae												
Orgyia vetusta (Boisduval)	-	-	-	+	+	+	-	-	-	-	-	-
Noctuidae												
Tetanolita palligera (Smith)	-	-	-	-	+	+	+	-	-	-	-	-
Mycterophora geometriformis Hill	-	-	-	-	-	-	-	+	+	-	-	-
Hemeroplanis finitima (Smith)	-	-	-	+	+	+	+	+	+	-	-	-
Hemeroplanis incusalis (Grote)	-	-	-	-	-	-	-	-	+	+	-	-
Melipotis indomita (Walker)	-	-	-	-	-	+	-	-	+	-	-	-
Melipotis jucunda Hübner	-	-	-	+	+	+	+	+	-	+	-	-
Bulia deducta (Morrison)	-	-	-	+	-	-	+	+	-	-	-	-
Synedoida ochracea (Behr)	-	-	-	-	+	+	+	-	+	-	-	-
Synedoida edwardsi (Behr)	-	-	+	+	-	+	+	+	+	-	-	-
Synedoida fumosa (Strecker)	-	-	-	+	+	+	+	+	+	+	-	-
Synedoida tejonica (Behr)	-	-	-	-	-	-	-	-	-	-	+	-
Ascalapha odorata (Linnaeus)	-	-	-	-	-	-	-	-	-	-	+	-
Zale insuda (Smith)	-	-	-	-	-	-	-	+	+	-	-	-
Zale termina (Grote)	-	-	-	-	-	+	-	-	-	-	-	-
Caenurgia togataria (Walker)	+	+	+	+	+	+	+	+	+	+	+	+
Catocala ilia (Cramer)	-	-	-	-	-	-	+	+	-	-	-	-
Catocala cleopatra Strecker	-	-	-	-	-	-	+	+	-	-	-	-
Catocala verrilliana Grote	-	-	-	-	-	+	+	+	-	-	-	-
Trichoplusia ni (Hübner)	-	-	-	+	+	-	-	+	+	+	+	-
Pseudeva palligera (Grote)	-	-	-	-	+	-	-	-	-	-	-	-
Autographa biloba (Stephens)	-	+	-	-	-	-	-	-	-	+	-	-
Autographa californica (Speyer)	+	-	+	+	+	-	-	-	-	+	+	+
Meganola fuscula (Grote)	-	+	+	+	-	-	-	-	-	-	-	-
Nola apera Druce	+	+	+	+	+	-	+	+	+	+	+	+
Tripudia balteata Smith	-	-	-	-	-	-	-	-	-	-	+	-
Cobubatha dividua (Grote)	-	-	-	-	-	-	-	-	-	+	-	-
Copibryophila angelica Smith	-	-	-	-	-	-	+	+	-	-	-	-
Eumicremma minima (Guenée)	-	-	-	-	+	+	+	+	+	-	-	-
Tarachidia candefacta (Hübner)	-	-	-	+	+	+	+	+	+	-	-	-
Conochares alter (Smith)	-	-	-	-	-	+	-	-	-	-	-	-
Conochares arizonae (Edwards)	-	-	-	-	-	-	-	-	-	+	-	-
Acontia cretata (Gr. & Rob.)	-	-	-	-	+	-	-	-	-	-	-	-
Acronicta othello Smith	-	+	+	+	+	+	+	+	+	+	-	-
Cryphia nanoides Franclemont	-	-	-	-	-	-	-	-	+	+	-	-
Cryphia viridata (Harvey)	-	-	+	+	+	+	+	+	+	-	-	+
Cryphia albipuncta (B. & McD.)	-	-	-	-	-	-	-	-	+	+	+	+
Apamea albina (Grote)	-	-	-	+	-	-	-	-	-	-	-	-
Apamea cinefacta (Grote)	-	-	+	+	-	-	-	-	-	-	-	-
Oligia marina (Grote)	-	-	-	+	+	+	-	-	-	-	-	-
Oligia tusa (Grote)	-	-	-	-	-	+	-	-	-	-	-	-
Oligia violacea (Grote)	-	-	-	+	+	+	-	-	-	-	-	-
Cobalos angelicus Smith	-	-	-	-	-	+	-	-	-	-	-	-
Xylomoia sp.	-	-	-	-	+	+	-	-	-	-	-	-
Benjaminiola colorada (Smith)	-	-	-	-	-	-	-	-	-	+	+	-
Mammifrontia riley Benjamin	-	-	-	-	-	+	+	-	-	+	+	-

Months	J	F	M	A	M	J	J	A	S	O	N	D
Archanara oblonga (Grote)	-	-	-	-	-	+	+	+	+	-	-	-
Helotropha reniformis (Grote)	-	-	-	-	-	+	-	-	-	-	-	-
Aseptis perfumosa (Hampson)	-	-	-	+	+	+	-	-	-	-	-	-
Aseptis n. sp.	-	-	-	-	-	-	+	-	-	-	-	-
Aseptis paviae (Strecker)	-	-	+	+	+	+	+	-	-	-	-	-
Aseptis pausis (Smith)	-	-	-	+	-	-	-	-	-	-	-	-
Aseptis genetrix (Grote)	-	-	-	-	+	+	-	-	-	-	-	-
Aseptis susquesa (Smith)	-	-	-	+	+	-	-	-	-	-	-	-
Chytonix divesta (Grote)	-	-	-	-	-	+	+	-	-	-	-	-
Properigea albimacula (B. & McD.)	-	-	-	-	+	+	+	+	-	-	-	-
Properigea suffusa (B. & McD.)	-	-	-	-	-	-	-	-	+	-	-	-
Pseudobryomima fallax (Hamp.)	+	+	+	-	-	-	-	-	-	+	+	+
Magusa orbifera (Walker)	-	-	-	-	-	-	+	-	-	-	-	-
Protoperigea posticata (Harvey)	-	-	-	-	-	-	-	-	-	-	+	-
Micranthetis triplex (Walker)	+	+	+	+	+	+	-	+	+	-	+	+
Platyperigea extima (Walker)	-	-	-	+	-	-	-	-	-	-	-	-
Platyperigea mona (B. & McD.)	-	-	-	-	-	-	-	+	+	+	-	-
Spodoptera exigua (Hübner)	+	+	-	+	+	+	+	+	+	+	-	-
Spodotera frugipera (Smith)	-	-	-	-	-	-	-	-	-	+	-	-
Spodotera ornithogalli (Guenée)	-	-	-	-	-	-	-	+	-	-	-	-
Galgula partita Guenée	-	-	-	-	-	-	-	-	-	+	-	-
Draudtia leucorena (Smith)	-	-	-	+	-	+	+	-	+	-	-	-
Draudtia funeralis (Hill)	+	+	+	+	+	+	-	-	+	-	+	+
Polenta tepperi (Morrison)	-	-	+	-	-	-	-	-	-	-	-	-
Lineostristiria olivalis (B. & McD.)	-	-	+	-	-	-	-	-	-	-	-	-
Nocloa rivulosa Smith	-	-	-	+	+	+	-	-	-	-	-	-
Cosmia calami (Harvey)	-	-	-	-	+	+	-	-	-	-	-	-
Homoglaea californica (Smith)	+	+	-	-	-	-	-	-	-	-	-	-
Homoglaea carbonaria (Harvey)	+	-	-	-	-	-	-	-	-	-	+	+
Pseudoglaea olivata (Harvey)	-	-	-	-	-	-	-	+	-	+	+	-
Agrochola purpurea (Grote)	-	-	-	-	-	-	-	-	-	-	-	+
Feralia februalis Grote	+	+	+	-	-	-	-	-	-	-	+	+
Pleromella opter Dyar	-	+	+	+	-	-	-	-	-	-	-	-
Pleromellodia cinerea (Smith)	+	-	-	-	-	-	-	-	-	-	-	+
Catabena lineolata Walker	-	-	-	+	-	-	-	-	-	-	-	-
Homoncocnemis fortis (Grote)	-	-	-	-	-	-	-	-	-	-	-	+
Oncocnemis nita Smith	-	-	-	-	-	-	-	-	-	+	+	-
Oncocnemis ragani Barnes	-	-	-	+	+	+	+	+	+	-	-	-
Lepipolys perscipta Guenée	+	+	+	+	+	-	-	-	-	-	-	-
Lepipolys behrensi (Grote)	-	-	-	+	-	-	-	-	-	-	-	-
Behrensia conchiliformis Grote	+	+	+	-	-	-	-	-	-	-	-	-
Cucullia serraticornis (Lintner)	+	+	+	-	+	-	-	-	-	-	-	-
Cucullia excissica Dyar	-	-	-	-	+	-	-	-	-	-	-	-
Cucullia eulepis (Grote)	-	-	-	-	-	-	-	+	-	-	-	-
Discestra chartaria (Grote)	-	-	-	-	-	-	-	-	+	-	-	-
Tripedia nova (Smith)	-	-	-	-	-	-	+	+	-	-	-	-
Admetovis similaris Barnes	-	-	-	+	+	+	-	-	-	-	-	-
Polia nipana (Smith)	-	-	-	+	+	+	-	-	-	-	-	-
Lacinipolia cuneata (Grote)	-	-	-	+	-	-	-	-	-	-	-	-

Months	J	F	M	A	M	J	J	A	S	O	N	D
Lacinipolia n. sp.	-	-	-	-	-	-	-	-	+	-	-	-
Lacinipolia stricta (Walker)	-	-	-	-	-	-	-	-	-	+	-	-
Lacinipolia strigicollis (Wallen.)	-	-	-	-	-	-	+	+	-	-	-	-
Lacinipolia quadrilineata (Grot.)	-	-	+	+	+	+	+	-	+	+	-	-
Lacinipolia patalis (Grote)	-	-	-	+	+	-	-	-	-	-	-	-
Dargida procincta (Grote)	-	-	-	-	-	-	-	-	-	+	-	-
Pseudaletia unipuncta (Haw.)	-	+	+	+	+	-	+	+	-	+	+	+
Leucania farcta (Grote)	-	-	+	-	-	-	-	-	-	-	-	-
Leucania februalis (Hill)	-	+	+	-	-	-	-	-	-	-	-	-
Leucania oaxacana Schaus	-	+	+	+	-	+	-	-	-	+	-	-
Perigonica tertia Dyar	+	+	+	+	-	-	-	-	-	-	-	-
Stretchia inferior Smith	-	+	+	-	-	-	-	-	-	-	-	-
Orthosia erythrolita (Grote)	+	+	+	+	+	-	-	-	-	-	+	+
Orthosia transparens (Grote)	+	+	+	+	+	-	-	-	-	-	-	-
Orthosia praeses (Grote)	+	+	-	-	-	-	-	-	-	-	+	+
Orthosia mys (Dyar)	+	-	-	-	-	-	-	-	-	-	+	+
Orthosia ferrigera (Smith)	-	+	+	-	-	-	-	-	-	-	-	-
Orthosia terminata (Smith)	+	+	+	-	-	-	-	-	-	-	-	+
Orthosia behrensiana (Grote)	-	+	-	-	-	-	-	-	-	-	-	-
Orthosia arthrolita (Harvey)	-	-	-	-	-	-	-	-	-	+	+	+
Orthosia pacifica (Harvey)	-	+	-	-	-	-	-	-	-	-	-	-
Orthosia hibisci (Guenée)	+	+	+	-	-	-	-	-	-	-	-	-
Egira hiemalis (Grote)	-	-	+	+	-	-	-	-	-	-	+	+
Egira crucialis (Harvey)	-	+	+	-	-	-	-	-	-	-	-	-
Egria cognata (Smith)	-	+	+	-	-	-	-	-	-	-	-	-
Egira curialis (Grote)	+	+	+	-	-	-	-	-	-	-	-	-
Egira rubrica (Harvey)	-	-	+	-	-	-	-	-	-	-	-	-
Anhimella contrahens (Walker)	-	-	-	-	-	-	+	-	-	-	-	-
Homorthodes communis (Dyar)	-	+	+	-	-	-	-	-	-	-	-	-
Protorthodes rufula (Grote)	+	+	+	-	-	-	-	-	-	+	+	-
Protorthodes alfkeni (Grote)	-	-	-	-	+	-	-	-	-	-	-	-
Protorthodes variablis (B. & McD.)	-	-	-	-	-	-	-	+	-	+	-	-
Protorthodes melanopis (Hamp.)	-	+	+	-	-	-	-	-	-	-	-	-
Ulolonche disticha (Morrison)	-	-	-	-	-	+	-	-	+	+	-	-
Zosteropoda hirtipes Grote	-	+	+	+	+	+	+	+	+	-	-	-
Miodera stigmata Smith	+	+	+	-	-	-	-	-	-	-	+	+
New gen., new sp.	+	+	+	-	-	-	-	-	-	-	-	-
Tricholita fistula Harvey	-	-	-	-	-	-	-	-	+	+	+	-
Agrotis vetusta Walker	-	-	-	-	-	-	-	-	-	+	+	-
Agrotis venerabilis Walker	-	-	-	-	-	-	-	-	-	+	+	-
Agrotis ipsilon (Hufnagel)	+	+	+	+	-	+	+	+	+	+	+	+
Agrotis subterranea (Fabricius)	-	-	-	-	-	-	-	-	-	-	+	+
Euxoa atomaris (Smith)	-	-	-	-	-	-	-	-	-	-	+	-
Euxoa auxiliaris (Grote)	-	-	-	-	-	-	-	-	-	-	+	-
Euxoa septentrionalis (Walker)	-	-	-	-	-	-	-	-	-	+	+	-
Euxoa olivia (Morrison)	-	-	-	-	-	-	-	-	-	-	+	-
Euxoa tocoyae (Smith)	-	-	-	+	-	-	-	-	-	-	-	-
Euxoa simulana McDunnough	-	-	-	-	+	-	-	-	-	-	+	-
Euxoa brunneigera (Grote)	-	-	-	+	-	-	-	-	-	-	-	-

Months	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Euxoa selenis (Smith)	-	-	-	-	-	-	-	-	-	+	+	-
Euxoa henrietta (Smith)	-	-	-	-	-	-	-	-	-	-	+	-
Euxoa perexcellens (Grote)	-	-	-	-	-	-	-	-	-	+	+	-
Euxoa difformis (Smith)	-	-	-	-	-	-	-	-	-	+	+	+
Pseudorthosia variabilis Grote)	-	-	-	-	-	-	-	+	+	+	+	-
Hemieuxoa rudens (Harvey)	-	-	+	+	-	+	+	-	+	-	+	+
Peridroma saucia (Hübner)	+	+	+	+	-	+	-	-	-	-	+	+
Anomogyna infimatis (Grote)	-	-	-	-	-	-	-	-	+	+	+	+
Adelphagrotis indeterminata (W.)	-	-	-	-	-	-	-	-	+	+	+	-
Abagrotis kirkwoodi Buckett	-	-	-	-	-	-	-	-	-	+	+	-
Abagrotis denticulata McD.	-	-	-	-	-	-	-	+	-	-	-	-
Parabagrotis formalis (Grote)	-	-	+	+	+	+	+	+	+	-	+	-
Heliothodes diminutivus (Grote)	-	-	-	+	+	+	-	+	-	-	-	-
Helicoverpa zea (Bodie)	-	-	-	+	+	-	-	+	+	-	-	-
Heliothis phloxiphagus G. & R.	-	-	-	-	-	+	-	+	-	-	-	-
Schinia pulchripennis (Grote)	-	-	+	+	-	-	-	-	-	-	-	-
Schinia buta Smith	-	-	-	-	-	-	+	+	-	-	-	-
Schinia oleagina Morrison	-	-	-	-	-	-	-	-	+	-	-	-
Schinia oculata Smith	-	-	-	-	-	-	-	+	+	-	-	-

[1] species observed only, not collected